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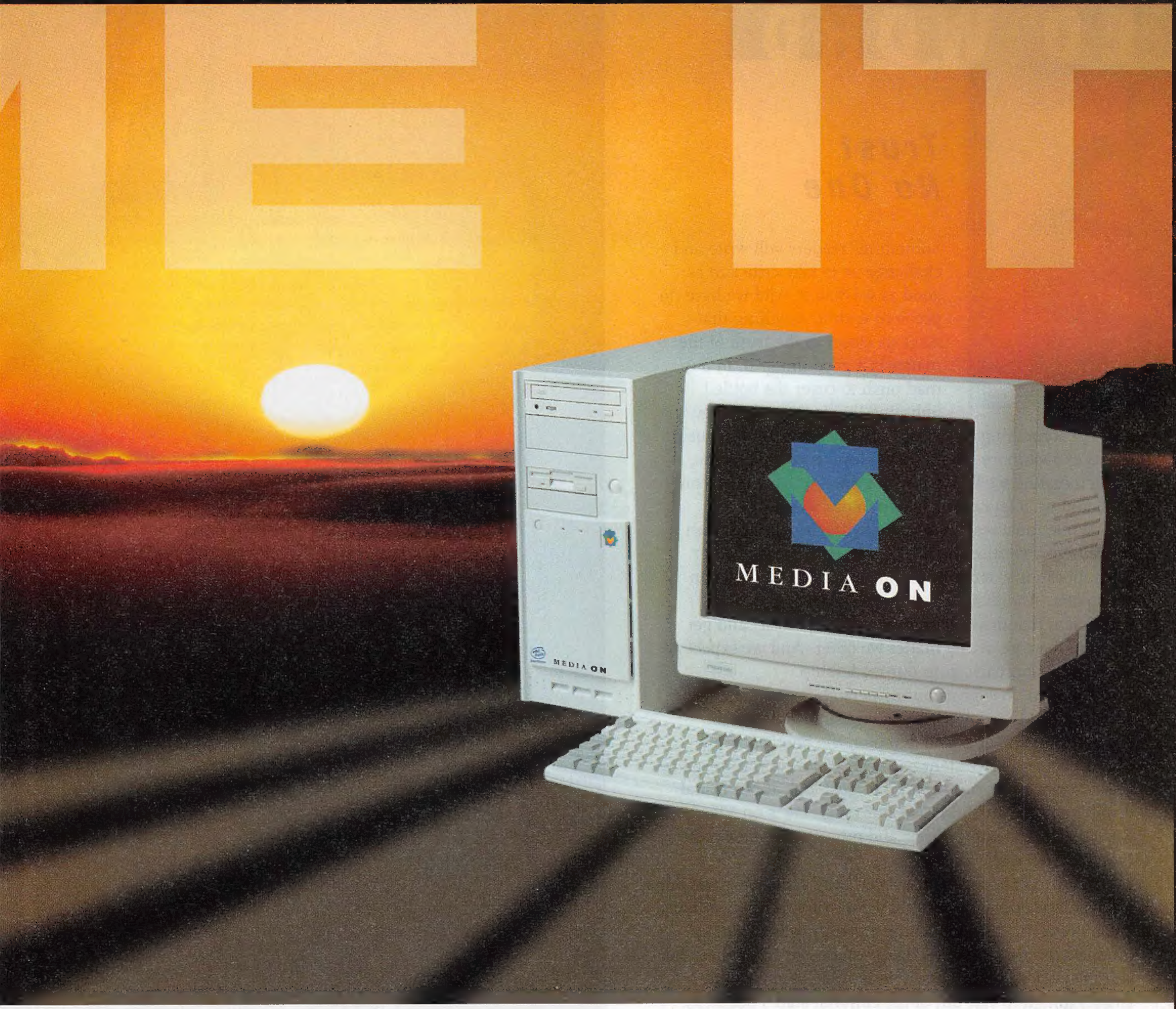

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ED WORD

Trust No One

Sometimes readers will write and challenge us to take criticism as good as we dish it. And we have no problem with it. Anything that takes us closer to the truth of the matter is a good thing. If, in our mad push to cover the bottled lightning that is PC technology, we ever get something mixed up, don't hesitate to notify us. If it makes *boot* more helpful to the loyal corps of readers, bring it on and we'll take it with grin. Accuracy is our only goal, and we'll let nothing stand in our way.

While most readers recognize that *boot* is free from the taint of advertiser influence that infests many other PC publications, sometimes our readers question us on the matter. And that's a good thing. That's the sort of skepticism that drives *boot* to question authority and get down to the core of any matter we cover. And we expect no less critical approach from our readership.

All I can do is give you my personal word that whether it's Microsoft's print advertising, 3Dfx's web site sponsorship, or a paid demo on the bootDisc from MicroProse, *boot*'s content has never been compromised by this association. If you need proof, just look at our brutal drubbing of the IntelliMouse, our tough takes on Voodoo Rush's 2D/3D compromises, and our utter beatdown of *Star Trek: Generations.*

While a magazine is most certainly a business and not a subsidized public utility, and we rely upon the advertising dollars of companies that come out with truly killer products (or are strong enough to stand our heat when they stumble), we've been blessed with publishers who are smart enough to stay out of the editorial staff's business. And our business is feeding you the steady stream of hardcore PC savvy you need to feed your habit.

And we love doing it!

If my job ever came down to stroking off some corporate sponsor, I'd walk. If it meant selling my soul like that, I'd go into a much-better-paying PR gig and do it right. Luckily, I don't foresee having to do that anytime in the near future.

I'm blessed to have a job where I get an honest day's pay for an honest (albeit frequently very long) day's work, and I sleep well at night.

If you ever smell something funny in *boot*, call me on it asap (bdosland@bootnet.com), but please… refrain from any name-calling until you get our side of the story.

Brad Dosland
Editor in Chief

***Tomb** Raider II, page 85*

NEWS

14 bootWire ***News** that **matters**. the bootBoyz recently hit the road and ripped **this year's Comdex** show a new one. We deliver the **skinny** on the CPU wars, 3D mayhem, DVD-RAM vapor-sniffing, fat-ass SCSI bandwidth busters, and the **horror** that is the sub-$1000 PC. ALSO Start shipping parkas to **Hell**, 'cause **Microsoft** has announced plans to **support** their opposite number: **SGI's OpenGL**. But will this make **Carmack** sleep better? Or is it just tossin' the dog a **bone?***

VOICES

23 The Saint ***Alex St. John** blueprints the next big OS: **DirectOS**. Read this and sign up to be a **beta tester** today!*

27 Game Theory ***T. Liam McDonald** warns against the false **prophets** who are just out looking for false **profits**.*

29 On the Line ***Shel Kimen** has come to a **stunning** realization: **Spam** sucks.*

31 Fast Forward ***Tom Halfhill** guides you through the **minefield** of new products ripe for your **upgrading** pleasure*

104 Glitch ***Jon Phillips** spent all month covering the **hottest** court case of the week: Camaro v. Camaro.*

DEPARTMENTS

5 Comm Port *Readers air out the **buzz** via e-mail, fax, and pancakes.*

12 bootDisc *Your guide to the **joys** of our shiny silver platter. A sampling of this month's bounty includes: **200** freaking megs of shareware that'll make your head spin! Plus the first ever **Falcon 4.0** demo, and much, much more!*

20 Pure Lust ***Tech** toys for **digital** girls and boys.*

***Altec Lansing** ACS495 Speakers, page 84*

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P/REVIEWS

66 Previews Something wicked this way comes, with Metabyte's **Wicked 3D** card based on Oak's smooth **WARP 5** technology. PLUS Auburn-friendly **Tonic Trouble** and **Falcon 4.0**

70 Reviews Technology marches **forward** and so do our benchmark **standards**. Check out the **new numbers** and see how the systems stack up against the **steeper** grade.

ALSO:

- Micron's Dual-P-II **Powerdigm** workstation wreaks havoc.
- **Permedia 2**–based OpenGL accelerators go **head-to-head**.
- **A-titles** test-driven include: **Tomb Raider II**, Longbow 2, **Myth**, **Heavy Gear**, Sub Culture, **Blade Runner**, Fallout, and Gettysburg!

FEATURES

42 Digital Shootout

It's a showdown at the **digital camera** corral, and all the hottest pix slingers are **shooting** to kill. Some **heavy hitters** are taking part in this year's shoot-out, including the 1280x1024-slingin' Olympus D-600L, Kodak's curvaceous DC210, and Canon's pocketable **PowerShot 350**.

Canon
PowerShot 350

62 bootWorthy

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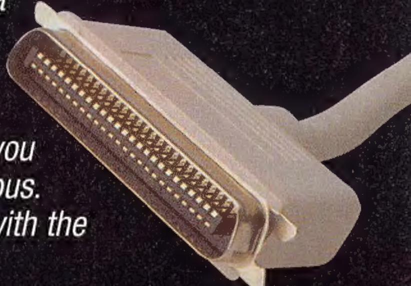
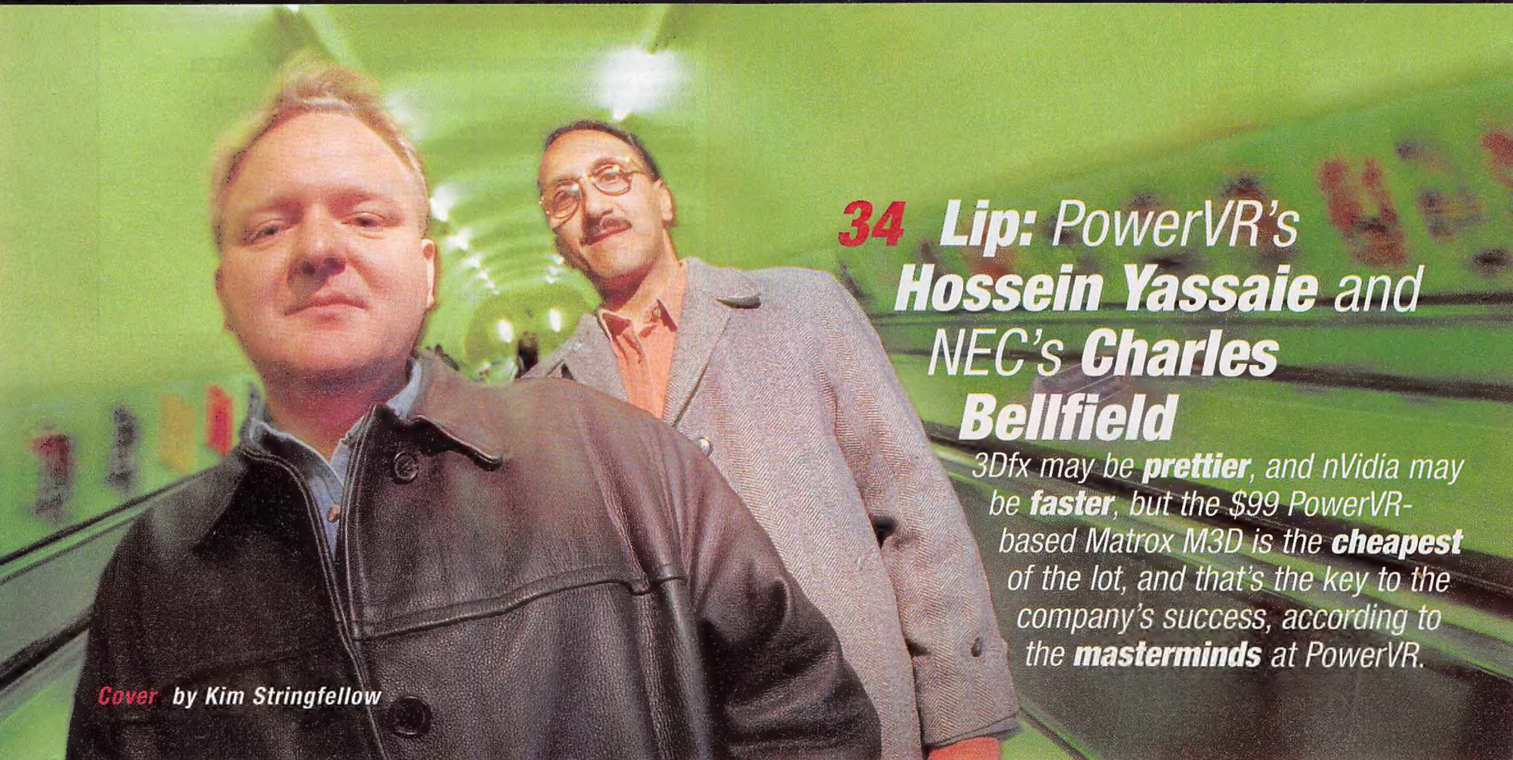
GLOBAL VILLAGE

When you're takin' it to the streets, you gots to keep it **tiny**. And that's where these indispensible PC cards come in mighty **handy**. Whether you're jacking into the hub, dailing into the mothership, or sending a fax to some Luddite, **we gotcha covered**!

54 White Paper: SCSI

Sure... Between SCSI-1 and SCSI-3 and Fast Wide SCSI and Ultra Wide SCSI and Ultra 2 SCSI, someone's bound to get a mite **confused**. So this month's White Paper steps in to slap these **specs** in line and make you the master of your SCSI bus. Dazzle those EIDE fools with the **quickness** that is SCSI!





34 Lip: PowerVR's Hossein Yassaie and NEC's Charles Bellfield

3Dfx may be **prettier**, and nVidia may be **faster**, but the $99 PowerVR-based Matrox M3D is the **cheapest** of the lot, and that's the key to the company's success, according to the **masterminds** at PowerVR.

Cover by Kim Stringfellow

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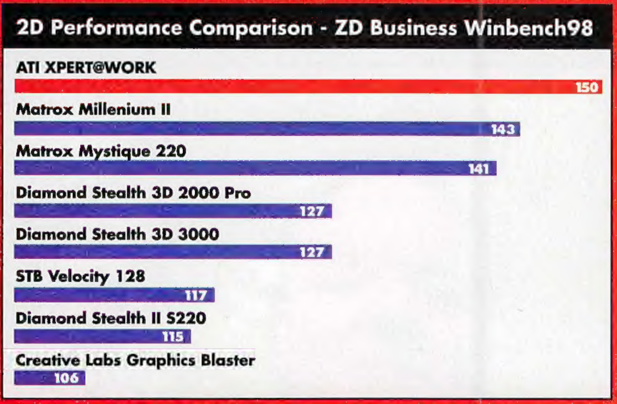

Tested on Pentium II MMX 300MHz/64MB/512 cache/Windows 95 OSR2/Test Mode: 1024x768x16bpp@75Hz
Tested using Driver Version: ATI XPERT@Work 4.31.H14P/Matrox Mystique/Millenium 4.03.3700/ Diamond Stealth 3D 3000 4.03.00.3217/Diamond Stealth 3D 2000 Pro 4.03.00.3212/STB Velocity 128 4.10.01.0107/Diamond Stealth II S220 V21004.10.01.0101/Creative Labs 5464 4.03.00.2147

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february 1998

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IMAGINE PUBLISHING INC
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INTERNATIONAL LICENSING REPRESENTATIVE
Robert J. Abramson and Associates, Inc.
720 Post Road, Scarsdale, NY 10583

volume 3, issue 2

boot *(ISSN 1088-5439) is published monthly by Imagine Publishing, Inc., 150 North Hill Drive, Suite 40, Brisbane, CA 94005, USA. Periodical class postage paid in Brisbane, CA, and at additional mailing offices. Newsstand distribution is handled by Curtis Circulation Company. Basic subscription rates: one year (12 issues) U.S.* ***$30.00****/Canada* ***$43.95*** *Canadian price includes postage and GST (GST #128220688).* ***POSTMASTER*** *Send changes of address to* **boot**, *P.O.Box 51479, Boulder, CO 80328-1479.*

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Standard Mail enclosed in the following editions: A3, B, B1, B2. CPC Int'l Pub Mail # 0781029. Outside the U.S. and Canada, price is $53.95, U.S. prepaid funds only. For customer service, write **boot**, *P.O. Box 51479, Boulder, CO 80328-1479;* **boot**, *150 North Hill Drive, Brisbane, CA 94005.*
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COMM PORT

Lust in My Heart

Out of all the magazines I get, *boot* is by far the most informative, stimulating, titillating, adrenaline-pumping, mind-blowing piece of techno literature I've ever read. I mean that in the most professional way. The style and writing of the magazine is absolutely superb. You give honest, truthful, no-nonsense reviews of the hardware and software and insight on what we should expect in them. It brought a tear to my eye when I saw all the top-of-the-line, state-of-the-art hardware for the Lust List and knew there was no way in Hell I would ever possess any of it. I can only experience it vicariously through this enlightening, almost sexual, PC mag called *boot*.

Phil

3D Card Junkies

If 3D cards were crack, you guys at *boot* would be major junkies, but apart from a tidbit here and there about a 2D card, there's very limited coverage (and not a one on your web site). I'm currently using a Diamond Monster for 3D, of course, but my 2MB ATI Mach 64 is getting to be on the dated side. So what would you recommend (and please no all-in-one, it slices, it dices, it works with your TV, type cards... hell I don't even watch TV anymore)? Just something blindingly fast and humble, the Shaolin monk of 2D cards as it were.

Sean Marcoux

Hardware editor Andrew Sanchez replies: *2D has become a place of diminishing returns. Just how fast do you want to scroll through your Excel spreadsheet? Seriously, though, for 2D with high resolutions, high refresh rates, and true-color depths, you should take a look at either Matrox's Millennium II or Number Nine's Revolution 3D—they may not do 3D all that well, but they sure pump 2D with a vengeance.*

Alien Death Ray Rebutal

McDonald's column (*boot* 16) clearly demonstrates his lack of knowledge in leading-edge technologies, and the active role of conspiracies across the planet. His assertion that a "tin foil hat will protect from alien death rays" is laughable. It's been scientifically proven that tin foil hats only protect from government mind-control devices. Protection from alien death rays requires an annual full body immersion in Mountain Dew, while wearing 100% pure wool socks.

John Koutsares

No *Quake* for NT

I recently contacted a local PC vendor to upgrade to a Pentium II. During our initial conversation, the salesman stated that it was a waste to run Win95 on a P-II and that I should consider NT. Fair 'nuff said I. "What applications do you use," he said. "*Quake*," said I. "Oh!," said he. "You can't run *Quake* on NT." Is this true or is he talking rubbish? I've also been told that you cannot run DOS with a Pentium Pro. Is this rubbish too?

Vince Gillard

Software editor Sean Downey replies: *Win95 runs well on a P-II, but because of its multithreaded, multitasking design, NT takes better advantage of the P-II. Like the P-Pro, the P-II uses the Dual Independent Bus architecture, which combines a dedicated high-speed L2 cache bus in addition to a system bus that accommodates multiple simultaneous transactions. The pure 32-bit environment of NT makes more efficient use of this architecture. The main problem you'll run into when running NT, that it doesn't support Win95's VxD virtual device driver model, so the many apps that depend on VxDs won't run. DOS based programs run into similar problems when they make direct calls to hardware and violate NT's security.* GLQuake *runs on NT, as does* Quake II *but the original DOS-based doesn't. DOS runs fine on a Pentium Pro, so your local PC vendor is indeed talking rubbish on that one.*

> "It's been **scientifically proven** that tin foil hats only protect from government mind-control devices."

Free Trade

What's the difference between the Linux that you have on the bootDisc and the version I can buy in the store for $140.

Robert B. Thompson

Web master Daevid Vincent replies: *The major difference is all the extras that these companies include with their "boxed" versions, one being printed manuals and detailed instructions on installation, the other being support.*

If you install linux by FTPing it (or buying a mirror CD), you must rely on your own brains, the abundance of HOWTOs and FAQs, as well as the help and support of the whole online Linux community to solve your problems—because there ain't nobody to call. If you purchase a "package" such as RedHat, Slackware, or Debian (which are freely available via FTP, by the way) you can get additional support via telephone from them too, but only if you purchased from them.

My advice is if you are not in a position to contribute code to the free-software movement, then purchase a complete package and help contribute to the linux community financially. Unfortunately, the nature of the beast is that companies will only develop software where there is money to be made, and although the Linux community is growing exponentially, it's user base still can't compete with the Windoze and Macincraps out there. So, if you enjoy Navigator 4.0 *for Linux, we suggest you pay the $30 and register it before there isn't a* Navigator 5.0 *because it isn't worth Netscape's time to support it.*

COMM PORT

The Streets Shall Flow with the Blood of the Non-Believers!

For all those jerks out there, namely the guy who called the SGI O2 a proprietary piece of junk and a waste of *boot's* bootmarking space, I have an announcement: The base price for the SGI O2 has just dropped from $12,995 to $5,902. For that sum, you get a 17-inch 1280x1024 monitor, 180MHz MIPS R5000 CPU, 512K cache, 64MB SDRAM, 2GB Ultra Fast/Wide SCSI HD, 100BaseTX/10BaseT Ethernet, 12x CD-ROM, 32-bit double-buffered graphics with hardware texture mapping, and Motion JPEG video compression.

Scott Parrish

Build 1212

I read in your great mag about win95vB build 1212. Where, who, what, when, how? I have looked high and low and can't seem to find it. I work in the MIS dept and have access to the newest PCs that come in the door. I look, and all of them are of build 1111.

Scott Davis

Disc editor Sean Cleveland replies: *Build 1212 of Windows 95 is the latest build of OSR2 that supports AGP. You can upgrade to Build 1212 by installing the USB supplement found on this month's* bootDisc *in the Workbench Section. The only reliable place to get your current version is by using Regedit. It can be found in HKEY_LOCAL_MACHINE under SOFTWARE\MICROSOFT\Windows\CurrentVersion\VersionNumber. Just remember that your machine must have USB support if you're going to install the USB supplement. Installing the supplement does not give you this support.*

Don't Delete

You don't have to complete Step 7 in the 12-Step in *boot* 16 on getting Win95(98) back up and running after reformatting the hard drive. By using the FDISK to repartition the disk, you don't need to use DELTREE. Also, you should FORMAT C: /S, but you should also /U to get away from the Image file. Since there was a new partition on the disk, why use DELTREE first?

Jay Harman

William Perry's PC

I really love your articles about overclocking, but I heard you guys bragging about your PC being in a refrigerator. I was wondering if you can do an article about making that old refrigerator into a computer case.

Eric Hrybinczak

Executive editor Jon Phillips replies: *Hell, we can explain it all right now in an instant 12-Step program: Step 1) Move your refrigerator from your kitchen to your office or den. Step 2) Throw out the rotting broccoli and old mustard jars. Step 3) Drill a hole in the back panel (avoiding the freon tubing). Step 4) Insert all your computer boards onto the shelves in the refrigerator and stuff the power cord, monitor cable, and keyboard/mouse cables out through the hole in the back panel. Step 5) Toss a bunch of silica packets on the boards to prevent moisture from building up. Step 6) Plug in all the cables. Step 7) Fire up the fridge. Step 8) Set temperature to a suitable level for your system (for dual P-II rigs, we recommend a setting of 8 or 9). Step 9) Turn computer on. Step 10) Put on your Ice Station Zebra parka. Step 11) Pull up a stool and use computer. Step 12) Now, buy a new refigerator for your kitchen (that broccoli ain't getting any younger).*

Cover Up

The latest issue of *boot* is great as always and the cover displays the most interesting form-factor motherboard I've ever seen in your magazine!

Vern Earlywine

OK, I know that 95% of your readers are most likely male. Yet, I am sure there are plenty of loyal female readers of *boot*, like myself. So, how about satisfying our lust and putting a picture of a semi-naked male holding his "Thrustmaster" on January's cover!

Janis Decker-Frisk

Looks like you've scored a homerun with this month's cover! Simply awesome. But as with most things it could be improved upon. How does a full-length shot with the addition of a strategically placed US Robotics conference link telephone sound?

Bill Rupp

"When did boot begin taking lessons from Cosmopolitan on using **sex** to sell magazines?"

I'm Peter from Holland, and I must say the *boot* 16 cover is immature, to say the least. I mean, we all know how a woman looks like. And I don't see you placing a picture of a guy having a sidewinder in front of his penis. So my conclusion must be that you are running out of inspiration for a good cover and using "sex" for a quick fix. So, stop jacking off and get creative again.

Jip

When did *boot* begin taking lessons from *Cosmopolitan* on using sex to sell magazines? I was shocked and embarrassed when I received *boot* 16 at work. The receptionist placed the magazine face down on my desk only to see a CD cover with the proclamation "Lust-O-Matic." I'm sure she thinks I'm receiving porno mags at work.

For crying out loud—this is a computer magazine! Sure, our hunger for better hardware is often like lust, but let's not let this magazine devolve into what other industry rags are doing. It isn't necessary to show a busty brunette caressing a joystick to pique the interest of readers. Computer users will buy just as quickly for the promise of an exposé on the latest 3D acceleration technologies.

Ray Geroski

Art director Kevin Ashburn replies: *I think* boot*'s decision to use a female model on the December cover was true to our editorial voice. As you know from our tone, boot has an often irreverent and comic approach that we think brings much needed levity and hipness to the otherwise dry techspeak that permeates other mags in our niche.*

Our approach, although based on hard research, is almost always wrapped in parity, sarcasm, or some form of comic irony. To that end, I think the December cover is a perfect reflection of what boot is all about. To suggest the level of "lust" for hardware has gone so far as to embody a woman was meant to elicit laughs, not groans, and also serves (I think) to set us apart from the usual spate of hardware covers that seem to be the indelible stamp of PC mags. We're evolving the category, not devolving it.

Jockey Itch

I immediately fell in love with the *Rocket Jockey* demo's addictive gameplay. When I had the money to go buy the game, I couldn't find it anywhere. The one sales clerk I found that even thought he could remember it said it had been taken down due to poor sales. I even called the phone number I found in the documentation and was on eternal hold, never once hearing the sound of a live person. So I question your addition of this updated demo on the *bootDisc.* Why get us all excited and addicted if we can't even get fullfilled, you little teases.

Raul David Rodriguez

News editor Bryan Del Dingo replies: *For everyone who wrote me (and there were a lot of you!) about the elusive 3Dfx patch, it does exist. But, according to the game's cool producer, it's way too large to download. However, if you call SegaSoft's Customer Service line (888.734.2763) you can request the patch on CD, which SegaSoft will send free of charge. Tell them boot sent ya.*

Paint By Numbers

1) I wanted to know what you think of the Abit LX6 motherboard with the 440LX chipset and AGP. Recent hardware tests have shown that it outperforms even the Asus P2L97 board that you guys recently awarded a Kick Ass.

2) I read that dual processors are absolutely useless under Windows 95 because Win95 can't use more than one processor. This person stated that Windows NT, however, can improve by having more than one CPU. Since I am about to purchase a motherboard/CPU combo from Falcon Northwest to install on my Mach V, I wanted to know if getting a motherboard with dual sockets and one processor is a good idea. Do you think that buying a motherboard with an extra slot and then filling it in later with another P-II is a good investment, or just frivolous? Should I get the extra slot just in case?

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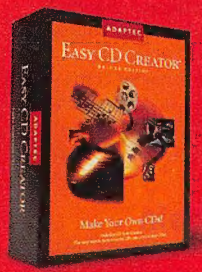
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COMM PORT

3) Another thing, will Merced or Deschutes be compatible with a board like the P2L97 or any Slot 1 architecture, or is Intel going to produce a totally new motherboard and chipset for these processors?

4) What is the next chipset after the 440LX?

Matthew Wensing

Hardware editor Andrew Sanchez replies: *Let's take these one at a time, shall we?*

1) Funny you should mention Abit—I have two Abit boards sitting on my desk at this very moment and am about to put these puppies through our benchmarks. You should see the results in an upcoming issue, alongside boards from M-Tech and FIC.

2) If you plan on intense 3D rendering under NT or working in other intense applications that benefit from dual CPUs, then go for it—get that dual CPU mainboard. We won't stop you.

3) Merced compatible with Slot 1? No. Knowing Intel, they'll come up with a new processor interface (Slot 3?!?) and new core-logic chipset to take advantage of the new 64-bit CPU. With Deschutes, that's a big yes for the newer 333MHz parts—it's Slot 1 and will fit right in there with your current Slot 1 mainboard. With the bigger L2 cache Deschutes, you'll need Slot 2 and the newer core-logic AGPset.

4) After the 440LX, expect the next core-logic AGPset from Intel to be the 440BX (for dual-CPU support) and the 450BX (for quad-CPU lovin')

When Win95 Attacks

I'm in operating-system limbo! I am still using Windows 3.11. I am very skeptical about giving in to Mr. Gates and using Win 95. I don't know if I should wait for Win98 (sounds like a mistake), go to NT 5.0 (coming soon to a computer near you), or stay with poor 3.11. I've seen disaster after disaster with people upgrading to Win95, as well as the registry nightmares from hell. Do you have any suggestions? Also, is there a list of which hardware devices are compatible with the myriad of OSes?

Charlie Garzoni

icrosoft
Windows95

"I've seen **disaster** after disaster with people upgrading to **Win95**, as well as the registry nightmares from hell."

Software editor Sean Downey replies: *Don't be afraid to upgrade. Win95 offers many improvements to the original Win3.x—more efficient memory use, virtual device drivers, and integrated support for 32-bit apps, just to name a few. Yeah, upgrading sucks, but running Win3.x sucks even more. At this point waiting for Win98 or NT 5.0 will put you even further into OS limbo, since release timelines for both are more slippery than Unreal's ship date.*

Win95's Golden Age

I was reading *boot* 16 and cruising through Lip. After reading Mr. Carmack's views on the MS vs. SGI API wars, I felt I had to let my opinion be known!

Here is my theory on Microsoft's place in the world: First of all, Microsoft isn't really all that bad. Windows has been an integral part of the computer revolution. Windows has created a unified computer "world." Even though it seems like some all-consuming giant, having one omnipotent operating system makes software accessible to the masses and has helped make the computer what it is today. I love Win95 but I think Microsoft has pointed itself in the wrong direction.

Microsoft began by creating a great operating system, not a bunch of fancy 3D APIs or web browsers or other stuff, except maybe word-processing software. Now Microsoft is trying to take over every software market there is, from the internet, to networking tools, to computer games, and this, I think, is the problem.

Microsoft should concentrate on making its operating system the best it can be and let other developers create the specialized and advanced tools. Windows should come with more things like Notepad and Paint Brush. These were simple tools, but they let you get the job done. Hell, I still can't live without Notepad because of its versatility and simplicity. While *IE* is fine, I think companies like Netscape are better because they can focus exclusively on one product area rather than trying to be some all-purpose swiss-army-knife company like Microsoft.

If you think I'm wrong, look at Win98. From what I have heard, it is just Win95, *IE*, and USB support, while it still has the same problems Win95 did. If Microsoft would just make one helluva great OS, like Win95 was (when compared to Win3.1), I think the world would stop hating them and we would enter the golden age of computing.

Bret Sadler

Descent into the Maelstrom

In John Carmack's Lip interview in *boot* 16, *Quake* is described as the first true 3D game. My friends and I beg to differ. *Descent* was the first game to use polygons and had 360-degree motion. I still recall the TV ads touting the advantages of *Descent* vs. *Doom* (*Doom* was still way cooler, imo).

monster

Not Fade Away

After receiving my last few issues of *boot*, I have noticed something missing. The White Paper seems to be fewer and farther between. I was hoping you could look into the matter. Many computer nerds out there know a great deal about what makes the computer tick, but even we can't know all the information we need. Without the White Paper I feel like a carpenter missing one of his valuable saws, or the high-paid assassin missing his cool ambiance. I subscribed to *boot* because it has real technical info while other mags just give you reviews (not that I don't love your reviews). I'm just mentioning it to make sure that this valuable resource doesn't slowly fade away.

William Blake

Editor in chief Brad Dosland replies: *We haven't bailed on White Paper (for proof, just check out this month's beefy installment on page 54). Every month, we have to make painful decisions about what's the hottest material we can cram into the limited pages we have to work with. Some months one department holds, another month it's something else. Trust us, we think White Paper rocks harder than Pantera!*

Desperately Seeking USB

In regards to your "The Gamer's Edge" article in *boot* 15, concerning what software you need to use AGP: It appears the only way you can get a copy of VGARTD.VxD from Intel is to join its AGP Forum for $2,500. Also I could find nothing on the Microsoft web site about USB support.

Jim Criner

Disc editor Sean Cleveland replies: *Look no further than our very own* bootDisc *for the USB supplement you seek. Go into our Workbench section in the* bootDisc*'s main menu or simply explore our CD, and find the USBSUPP.EXE file located in the /Utils/Utility/Usbsupp folder. This will update your OSR2 version to Build 1212 and update your necessary files for AGP readiness. As for the VGART.VxD, this should be provided by the video-card manufacturer as part of its driver set when you purchase its card.*

Mastering Thrust

I bought your Dream Machine in *boot* 13, only to find out that you can't use the Thrustmaster joystick with it because the Diamond Monster Sound doesn't work with any digital joysticks. How could you do that? And what can I do to get the Thrustmaster working?

Tom Barron

News editor Bryan Del Rizzo replies: *Yeah, we suck. Big time. We didn't catch this enormous faux-pas until after the issue closed. However, after a long wait, Diamond has released a beta software fix. Check out* www.diamondmm.com/products/drivers/monster-sound.html#beta *for installation and downloading directions. If using beta drivers doesn't wet your whistle, you might want to consider installing a dedicated ISA gamecard. CH Products' (*www.chproducts.com*) Gamecard 3 Automatic and Thrustmaster's (*www.thrustmaster.com*) ACM Game Card are both terrific, and retail for under $40. Check your local store (CompUSA, Computer City, Best Buy, etc.) or your favorite online store.*

Kilt and Kilt Again

In the *boot* 15 article "Stalking the Rebel OS," something wasn't quite right. "But you're a rebel. You listen to Butthole Surfers. You eat rattlesnake meat. You wear a kilt. And by any means necessary, you pump your Intel silicon with an alternative OS."

Wait a minute.... Would a rebel use an Intel processor? I think not. I may just be nit-picking, but I think AMD would have been the better choice for any self-respecting rebel running a rebel OS.

WindWalker

Multiple CPU Orgasms

Will Windows 98 support multiple CPUs, or will I have to run NT 5 to do this?

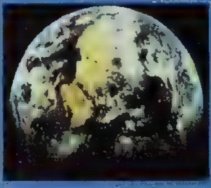
Steve Campbell

Software editor Sean Downey replies: *You'll need to run NT 5 to get multiple processor support. Win98 is just an extension of the old Win3.1/Win95 code with more features. In order to maintain legacy software support, the core OS modules haven't been expanded to take advantage of multiple processors.*

WYSIWIG=WYSIMWYG

In response to Shel Kimen's piece about WYSIWYG editors (*boot* 16), I have a few questions and comments.

To err on the side of doing things the old-fashioned way is always the case when emerging technologies first come out. If you are that bent on writing HTML in Notepad, *BBEdit*, or even *Hot Dog*, then I say go for it. You can use rocks and chisels and pound your HTML into stone tablets in Latin for all I care. I am curious though, how do you create a site with "thousands upon thousands" of pages while coding by hand?



"**Microsoft** isn't really all that bad. Windows has created a **unified** computer 'world'."

Do your clients give you a couple of years to get the job done? Mine sure don't. Do you have a team of people slaving away on their little text editors to crank out a 2,000-page job in a month or two? I sure don't.

Do you always cater to clients that have the widest possible audience so you can use every Java, Javascript, ActiveX, or plug-in-based technology that exists? Mine don't. You see a trend here? I do. Time is money and clients have different needs.

Lets face it, if you want to implement all the tricks of the trade and do 100% custom work all the time, then yes, coding by hand is the way to go. If you want to get a good, clean layout that is uniform across multiple tiers of pages, and do it quickly, then WYSIWYG is the way to go. As long as you understand going into the process that it is actually more like "What You See Is Mostly What You Get," then you will have no problems.

Scott Dahlstrom

I agree with Shel Kimen in that with any HTML pages you do, you have to know HTML and often have to write the code yourself because no WYSIWYG HTML editor does everything.

However, if you could use a WYSIWYG HTML processor to help with the simpler tasks, *AOLPress* 2.0 (formerly *GNNPress*, which earned 4 stars from *boot*) writes clean readable code. It does most everything and is free for download from *www.aolpress.com*. It is customizable and quick to learn. I use it for all my basic stuff and hack the resulting code for any special needs I have.

I wouldn't recommend *FrontPage* to anyone.

Peter MacDougall

Bjorn Free

At the top of page 110 in *boot* 16, you mention a program called *GLQ+* by Bjoern Stensrud. Where can one get this program?

Bruce

Software editor Sean Downey replies: GLQ+ *allows you to directly configure 3Dfx settings for* Quake, QuakeWorld, *and* Hexen II. *With this little utility you can tweak all the* OpenGL *parameters in* Quake, *set refresh and gamma, push latency in* QuakeWorld, *and even overclock your 3Dfx card. It's on this month's* bootDisc *in the Workbench section, and available for download at* www.idi.ntnu.no/~bjoernst/quake/glqplus.html.

Jack Off

In *boot* 16, you said the Diamond Viper 330 has video input and an AC-3 audio jack. So I went to buy one, but they don't have the jacks you said (they do have holes for them but they're sealed with solder). It was just like an STB Velocity 128. Is this false information? I really feel betrayed by my favorite magazine.

TurtleCat

Hardware editor Andrew Sanchez replies: *As I write this reply, I have in front of me the board reviewed. This is a final, shipping, boxed product. The board is marked Revision 1. On the I/O connector are the AC-3 and video input (as seen in the picture of the card on page 104). What's really hilarious is the picture on the box for the Viper V330 shows the board without the connectors!*

So, if you really want to know whether the one in the store has the connectors, ask the salesperson to open the box for you and check for yourself.

Sony PVC Upgrade

Your review of the Sony PCV-150 in *boot* 15 was right on the mark. I am as impressed with this machine as you are. However, on the chart plastered on the power supply, the frequency multiplier table is incorrect. The first setting listed (1.5x 1-2,4-5) is actually the setting used on the motherboard for the multiplier of the installed P233MMX. This

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COMM PORT

setting is actually the 3.5x setting. There is no 1.5x setting.

This brings me to my second point. The Sony PCV-130 is virtually the same computer as the PCV-150 with the exception of the installed P200MMX. If you change the frequency multiplier to the above described setting, you get your 233MHz. I know this works because I tried it on the machine that we have on demo where I sell computers. As much as I'd like to tell my customers this little nugget, alas I cannot. Besides, the extra 200 bucks they spend on the PCV-150 doesn't bother me a bit.

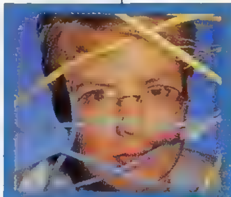
Marc Goodman

Sell the Dream

I was wondering if you approve others building your Dream Machine and making money off of it. You run an ad for one in the back of your magazine, but what do you think of their "improvements"?

Josh Catone

Editor in chief Brad Dosland replies: *We don't care if companies build the machine we outlined in the Dream Machine feature (*boot *13). It's a free world and we don't mind them making a buck off our good ideas (unlike some software companies we know). While we don't endorse any of these products and make no guarantees about the authenticity or quality of the parts and assembly, we do hope the Dream Machine mission leads to companies putting together better systems. As for our improvements... you'll hafta wait for the unveiling of Dream Machine 98 in* boot *25.*



"How do you create a site with thousands upon thousands of pages while ***coding by hand?***"

Collusion Detection

I'd like to reply to a letter posted in the *boot* 16 Comm Port by Paul Silverstein entitled "3D Card Collusion."

It has always been my opinion that you should not write a letter to the editor unless you know what the hell you are talking about. Throughout your article you talk about how LucasArts is in cahoots with 3Dfx, so they can make games that require 3Dfx hardware and share profits. First off, that, my friend, is a load of crap. *Shadows of the Empire* was ported from Nintendo 64 to PC. N64 has its own 3D processor, which a computer does not. So, they decided to require a 3D card so they would not have to make the graphics suck for the PC version. They used the D3D standard; it was not specifically ported to 3Dfx. If you look at the bottom of the box or at the README, it supports 3Dfx Voodoo, Rendition Vérité, Creative Labs' Permedia 2, and other chipsets of equal or greater power. Sure, you could run it on the Mystique, but not only would you not get the shadows, you would lose texture quality, framerate, fog, transparencies, lighting effects, and more. If I wanted to, I could force it to run on my ATI 3D Expression that is about two years old, but it would sucks.

The fog is replaced by huge black squares, the laser fire is surrounded by black squares, and framerate drops below 18fps. If you want to take your little Mystique and run *Shadows of the Empire*, go for it, good for you. But I'll tell you this, if you ever stopped dissing on hardware acceleration long enough to try it, you would never go back to software acceleration. This is not conspiracy, this is what is called advancement. No one is trying to screw all the people out there still doing software rendering, they are simply taking advantage of new technologies that can make the games cooler. So, next time you feel queasy in the stomach, vent out of your ass and not out of your mouth at good honest companies like 3Dfx and LucasArts.

Scott Parrish

56.6 Scam?

I am writing this on behalf of the hordes of unhappy x2 customers from US Robotics.

Have you visited the newsgroups of late? There are many frustrated customers who bought x2 modems with the hope of connecting at speeds higher than 28.8 or 33.6. It is not clear to me that any of your customers achieve significant connection speed enhancements. I know, I know, the FCC doesn't permit speeds up to 56.6Kbps (is there a false advertising issue here?), but I'd accept something better than 28.8. Here's my favorite: if you look at the FAQs on AOL, there is no FAQ dealing with connection speed.

What I am looking for is 3Com/USR to actually complete its obligation to its customers and help resolve the connection speed issues. Tech support or online paths that can actually address our issues would be a good start. In lieu of that, they should consider a refund policy for all who wasted their money on this upgrade with the hope of actually taking steps forward. I am not looking for a personal response to my issues, but rather for 3Com to deal with all their customers in a professional and competent manner.

Michael Sottile

I wanna know what's up with ya'll bashing 56K modems? 56Kbps works, plain and simple. If you can't get it to work, it's your wiring or your phone company, not the technology. I have a 56k modem (USRs Cheap, yet totally studly Sportster) and have had one since the day they came out. Guess what? Mine works. You know why? Because my little tiny, itsy-bitsy portion of Bellsouth actually wired my home right in the first place.

Actually, one of my lines in my house did not work with 56Kbps, while the other did. My solution—get a third line installed, so it goes on the new switch/wiring to the main Bellsouth hub, then get my first line disconnected. Violà, dual 56.6Kbps lines in my house, all working nicely. So, it's not the technology. You bash it because you can't figure out how to use it right!

Josh Zerlan

Executive editor Jon Phillips replies: *Modem speed is a real hot point with our readers. Many are mad as hell about not getting what they paid for and others are happy as clams with their blazing new throughput. Phoneline quality is the single-most profound determining factor in whether users will achieve (or even approach) consistent throughput above 50Kbps. Certainly, modem manufacturers should publicize the fact that many consumers will never get the celebrated numbers.*

The Gold Standard

In *boot* 17's Comm Port, B.J. Loyola asked about hooking a computer up to a stereo. David Herald replied, "Yes Virginia, you can play *Quake* at 200 watts until your ears bleed." (I'm paraphrasing). What David doesn't realize is that not all sound cards are stereo compatible.

If you have a SoundBlaster card that's not of the "Gold" variety (like my SB16 or even my SB AWE64 at work), the line-out jack has enough power to run a small pair of nonamplified speakers. This is great for dweebs who won't spend more than $15 on computer speakers, but not people like us with cool stereos. If you attempt to follow Dave's advice, you will be greeted with an incessant hum that would drive the Alien Queen Mother out of her mind in minutes. Creative Labs says, "Sorry Chuckles, you shoulda ponied up the extra $100 for the Gold card, which has a true line-level output for Denon freaks like yourself." (Again, I'm paraphrasing).

Dan Hull

Prairie Home Companion

I was reading the review of the Gateway G6-233 (*boot* 17). I happen to work in the manufacturing department for Gateway 2000, and noticed in the "I'll take door number one, Monty" caption that you thought that we should put the system serial number on the inside of the front cover. Well, if you look on the right-hand side of the bezel after removing the front cover, on the side there should be a sticker with the serial number printed on it.

Shad Mutchler

Hot Heather on Heather Action

I have a Pentium 200 MMX with 32MB of EDO RAM. I have noticed recently severe swap-file activity with graphically intensive games such as *Jedi Knight, Hexen II*, and *Quake II*. I use my Monster 3D Voodoo card on all three games, which look stunningly beautiful. But they all use the swap file a lot, causing noticeable pauses in the game when walking around a corner or when new graphics or guys are approached. I have the fastest Western Digital hard drive, but it could never keep up with the speed of the RAM. My question is: Would buying more RAM stop the use of the swap file in these games? Would these games take advantage of the extra RAM and load the entire game into RAM, or are they not written that way? I did a full install on all these games thinking that would help, but it did not. I'm willing to go out and buy 64 more megs of RAM if you convince me it would help eliminate the slow down and pauses. Or is more RAM a waste of precious money?

Heather Walton

Reader Heather Walton replies: *Since I sent this letter to you yesterday I went out and purchased 64MB of RAM. I can answer my questions now, and I thought I could help answer similar questions* boot *readers have about RAM, as well. My system now has 80MB of RAM, and I thoroughly tested it on* GLQuake, *Quake II, and Jedi* Knight. *The entire game must have loaded into RAM on all cases, because the hard drive light never came on, and there we absolutely no pauses at all! These games ran smooth as silk! Also, when I quit out of the game back to Windows, the swap file did not unload for minutes like it used to do. In fact, there was absolutely no swap file to unload at all! All said, 64 more megs of RAM is well worth $150 when it comes to fixing the slow-ups and the constant unloading of the swap file.*

3DfX Under NT

Does the 3Dfx card work under NT?

Vincent P. Wright

Hardware editor Andrew Sanchez replies: *It depends on what API you're trying to accelerate. Direct3D? No. Not until NT 5.0, which promises full DirectX hardware support. Glide? Yes, provided the program in question will run under NT, but it'll work with Voodoo ONLY—not Voodoo Rush.* OpenGL/Quake? *Yes. We saw Voodoo 2 running under NT4.0 accelerating* GLQuake *to the extreme... and beyond.*

NT Drivers

Your irreverence is what sets *boot* apart, but you have technical depth to back it up. For instance, take the nVidia review in *boot* 16. Instead of simply saying this one is faster for this, that one is faster for that, you tore apart the nVidia chip to see how it worked and exposed all of its technical strengths and weaknesses.

And at the end of the review you stated, "Currently the Viper and the Velocity are so similar, they can run each other's drivers."

Well this brought up an interesting solution to a thorny problem I had with a new computer. I just purchased a new Micron Xku 266 running Windows NT 4.0/SP3, and a Viper V330. This machine is magnificent; however, it had one severe problem. Often, when dragging windows around or while the Microsoft Office tool bar was going in or out, the display would just go black. At first I thought this was a display problem and the machine was still running, but no. The machine had crashed and crashed hard. It would not even shutdown with CTR-ALT-DEL-Right Arrow-Right Arrow-Return. NT doesn't often crash and this was a crash of stentorian proportions.

As you know, video drivers were allowed into the lowest levels of the OS in NT 4.0 for performance reasons. NT runs faster, but the downside is that a poorly written driver can crash NT. I believe this is what was happening. I think the Diamond AGP Viper V330 board's driver was making NT hemorrhage.

I surmised that if the STB and Diamond Win95 drivers would work on either video board, as you said, then maybe the NT drivers would work as well. So I downloaded the STB drive, and guess what? Not only did it work, but the machine stopped crashing! I think STB may be a little more careful with their driver development than Diamond.

"Without the **White Pages** I feel like a high-paid assassin missing his cool ambiance."

Just thought you'd want to know that you saved my system and saved Micron a sale. I really respect Micron and would buy from them again. But they should be more careful, especially when it comes to NT machines and their stock configurations.

Ben Smith

Getting Giger

I have a quick question about the Debian Linux distribution you gave out in *boot* 15. You showed a picture of a Giger-esque X-Window interface on page 57. I'd like to know what Window Manager interface that was and where I can get it.

James Argus

Web master Daevid Vincent replies: *That is one of many themes for a new X-Window manager called "Enlightenment." It allows radical modifications of windows and their properties. More than 20 themes are available from the main web page at www.rasterman.com, but be warned, it's still in development and not as stable as fvwm.*

Adaptec Conspiracy

I am wondering why you guys never mention the excellent alternative to Adaptec SCSI controllers. There is a whole line of cards featuring the Symbios (NCR) 53C8XX chips. These are excellent cards! They can be seen at www.swt.com. At $53 for a 2940 (not UW) equivalent, it can't be beat. Plus, the BIOS for this card appears in a number of motherboards. (ASUStek for example). Asus also has a card based on the chip as well. The cards work all the way up to Ultra Wide. The Ultra Wide sells for $159. All versions are supported under Windows 95 and NT. (It is well-supported under Linux as well. A key selling point to me.) I would love to see this card benchmarked against Adaptec. I wonder if the $$:Threadmarks ratio would be that high.

Don Weeks

Disc editor Sean Cleveland replies: *We have yet to review an Adaptec SCSI controller, as they have not shipped a new controller since* boot *began. In the past, we've reviewed controllers from Tekram, Diamond, AdvanSys, and ATTO, all of which used the Symbios 53C8XX chip. We will be reviewing Adaptec's 2940 UW Dual controller and the new Ultra 2 cards soon. And as for the Asus Ultra Wide controller being reviewed, your wish is our command, look for it in future issues.*

Bold Statement

Just got my FIRST (and LAST) issue of your MAGAZINE. I think it is RIDICULOUS that you BOLDFACE every third WORD in your SUPERFICIAL rag. I suppose that APPEALS to the AUDIENCE of 19 year olds you TARGET. They seem to use PCs only for GAMES and have an intellectual DEPTH of about 2 millimeters. Keep throwing in the adjective KICK ASS every page or two and I am SURE they will be SATISFIED.

Clark Coleman

Art director Kevin Ashburn replies: *You CAN'T win 'em ALL, Clark.*

Cut, Copy, Paste

On page 114 of *boot* 16, the product information and scores for the Jazz Adrenaline Rush board and the Intergraph Intense 3D Voodoo board were switched.

In *boot* 16, on page 44, the maximum resolution for *Total Annihilation* was listed as 800x600/16-bit color. In fact, it can go as 1280x1024, and with enough video memory it can go as high as 1600x1200.

In the *Joint Strike Fighter* preview on page 90 of *boot* 16, a MiG-29 Fulcrum is misidentified as an F-14 Tomcat.

In the "Lust List" feature in boot 16, the price of the Epson Color Stylus 3000 on page 64 should be $1,699 (find it at *www.MicroOutlet.com*), not $449.

In the *boot* 16 "Lust List," the CTX flat panel referred to on page 62 is the PanoView 600 flat panel.

The DriveCopy review on page 104 of *boot* 17, should have said "the target drive must be the same size as or larger than the source drive."

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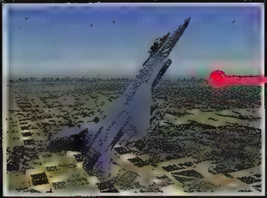
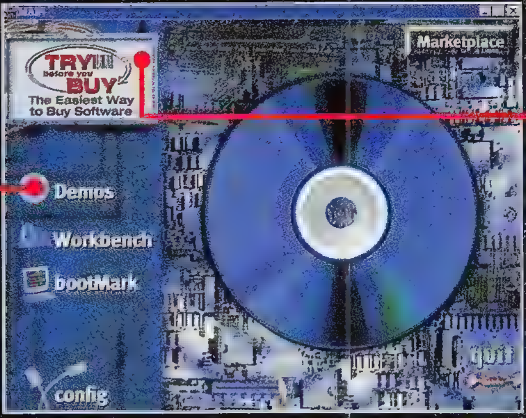


Falcon 4.0: Imagine your computer is the cockpit of an F-16 Fighting Falcon, one of the premiere dogfighting and air-to-ground combat aircraft in the world. Enter the world of *Falcon 4.0*, with 16-bit graphics and 3Dfx support, the closest you can get to the real thing.



SOFTWARE DEMOS:

ARMORED FIST 2
M1A2 ABRAMS

Armored Fist 2: Take charge of the U.S. military's newest tank, the M1A2 Abrams. Seize enemy bases, engage ground and air targets, and call in artillery and air strikes. VoxelSpace 2 rendering technology creates fast, photo-realistic terrain with which to wage war. See the review in *boot* 17 on page 116.

CD ARCHITECT

CD Architect: Design professional audio CDs to Red Book specs with *CD Architect*. Features such as support for 99 tracks per disc, PQ code editing including track and index positions, and independent-channel master volume faders make *CD Architect* a tool for professional audio editing and mastering. See the review on page 88.

Defiance: Defeat and obliterate your enemies using LaserLok targeting systems in this new first-person shooter. Lock onto the target, focus the twin laser beams, and blast them to smithereens. Four levels of gun firepower along with multiple missile types and auxiliary weapons make *Defiance* a game for the discriminating veteran.

Myth
THE FALLEN LORDS

Myth: The Fallen Lords: In a world of walking dead soldiers and ancient sorcerer-generals, you must command infantry, archers, molotov-lobbing dwarves, and walking zombie-bombs against the Fallen Lords in this truly unique real-time war sim. Line of sight, 3Dfx support, blood, and dismemberment make *Myth* a must for wargame fanatics. See the review on page 84.

PANZER II GENERAL

Panzer General II: Witness the Living Battlefield, featuring hand-rendered maps, faithful WWII battlefields, and rendered combat units, and wage battle through WWII's Eastern and Western Fronts, North Africa, and even the continental US. A successful "Panzer General" devises sound strategic plans and carries them out with unswerving commitment. Can you?

PAX IMPERIA
EMINENT DOMAIN.

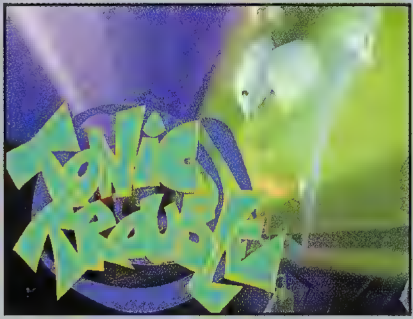
Pax Imperia: The goal of *Pax Imperia: Eminent Domain* is nothing short of total domination and the complete destruction of all enemy forces. Your species competes on a galactic scale for limited resources, and only skillful management will lead to victory. Do you have what it takes for galactic conquest?

SUB CULTURE

Sub Culture: An underwater 3D action-adventure game, *Sub Culture*'s physics-based dynamics modeling, real-time 3D graphics, and underwater special effects make this a visually stunning game. Contains a complicated underworld of waterways, pipes, rivers, streams, cities, and atmospheric effects. See the review on page 80.

TOMB RAIDER II
STARRING LARA CROFT

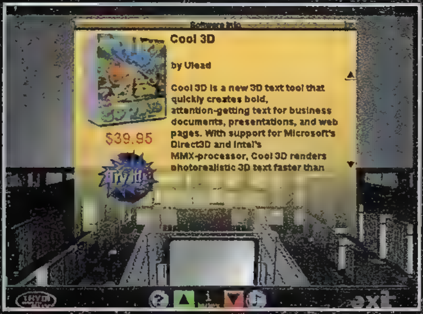
Tomb Raider II: Return with Lara Croft as she searches for The Dagger of Xian. This sequel features dynamic lighting, new moves such as climbing walls and wading in shallow water, new clothing including a wet suit and bomber jacket, and new weaponry. The game engine has also been refined, giving smoother control of Lara and her ass-ets. See the review on page 85.



Tonic Trouble: A friendly extraterrestrial named Ed has to retrieve a mysterious can that he accidentally dropped from space onto Earth. And it's not as simple as it sounds. You'll explore outrageous worlds, solve zany problems, and avoid enemy traps and attacks throughout *Tonic Trouble*'s graphically stunning, cartoon-like ambiance. See the preview on page 68.

Try-Before-You-Buy Software Store:

boot gives you what you the reader demanded, the ability to try premiere software first with the chance to buy. We've made it easy, all you do is walk the aisle, shopping basket in hand, dragging and dropping titles into it. If you're not into the interactive thing, then click the "index" button on the bottom of the screen for a full listing of all we have to offer. And yes, they will change every month. Think of it as an extension of the Workbench.


Software Info

Cool 3D

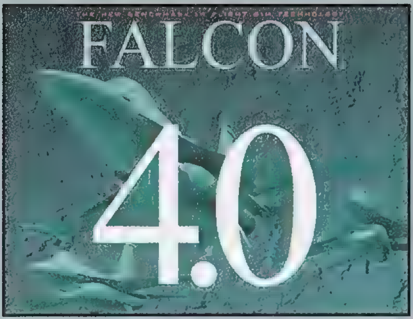
by Ulead

Cool 3D is a new 3D text tool that quickly creates bold, attention-getting text for business documents, presentations, and web pages. With support for Microsoft's Direct3D and Intel's MMX-processor, Cool 3D renders photorealistic 3D text faster than

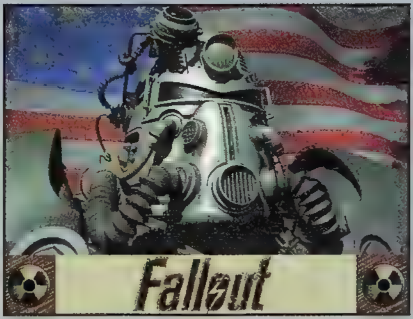
$39.95

No CD? We Can Help

Fear not if you're holding a naked edition of *boot* with no *bootDisc* CD-ROM. You can subscribe to the full magazine/CD-ROM bundle, and even order individual copies of the *bootDisc*, by calling customer service at 800.274.3421. Each month, the *bootDisc* is stuffed with game demos, application demos, utilities, and patches–so don't miss this treasure trove of valuable software.



Falcon 4.0: Take control of an F-16 jet fighter and fly missions over the Korean peninsula in this balls-out air combat sim. Detail to the 3D photorealistic, texture-mapped landscape and the F-16 itself via Direct3D and native 3Dfx support make this combat flight sim immersive. Direct3D and native 3Dfx support is included.



Fallout: Set in the aftermath of a worldwide nuclear war, this third-person role-playing game uses detailed character generation and tactical turn-based combat. Characters grow via combat experience and adventuring, advancing their skills and abilities in a large interactive world. If you liked *Diablo*, you'll love *Fallout*. See the review on page 94.

SEVEN
KINGDOMS

Seven Kingdoms: Take control of any of seven emerging civilizations: Chinese, Persians, Japanese, Greeks, Normans, Vikings, or Mayans in this new real-time strategy sim. Wage open warfare on your rivals, or forge alliances with them. Send spies to infiltrate their ranks or have your scientists research new weapons of war. The choice is yours.

SID MEIER'S
GETTYSBURG!

Sid Meier's Gettysburg!: *Sid Meier's Gettysburg!* is a real-time strategy game simulating one of the most dramatic battles in history. Control 3D animated soldiers, cannon, cavalry, and generals that move, change formation, fire, retreat, and attack in real-time. See if you have what it takes to actually take the Union. See the review on page 95.

TOTAL
ANNIHILATION

Total Annihilation: You are a commander, a futuristic K-BOT. Powered by the reactor at your heart, you can build an entire complex of war. Features 3D environments including realistic terrain with elevation, run-time generated 3D units and buildings, and true 3D terrain that units must climb over, into, and around. See the review in *boot* 16 on page 44.

Warbreeds: With *Warbreeds*, real-time strategy is about to evolve, literally. You get a choice of four alien clans, each with unique skill sets and attributes that you use to capture your enemies' genes through conquest. You ultimately use that knowledge to customize your own units through genetic engineering for optimal strength in battle.

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CuteFTP 2.0	GlobalSCAPE
Flash 2	Macromedia
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HotDog 4.5	Sausage Software
Internet Explorer 4.0 (3.1)	Microsoft
Internet Explorer 4.01 (95)	Microsoft
Java Studio	Sun Microsystems
NetMeeting 2.1	Microsoft
Oil Change	Cybermedia
ShockWave	MacroMedia
SiteFX 1.4	Sausage Software
Visual Page 1.0	Symantec
Survival	
3D Control Center	Jayeson Lee-Steere
Acrobat - 16-Bit	Adobe
Acrobat - 32-Bit	Adobe
ActiveMovie	Microsoft
PKZIP 2.50 (16bit)	Pkware Inc.
PKZIP 2.50 (32bit)	Pkware Inc.
QuickTime 16-Bit	Apple
QuickTime 32-Bit	Apple
Win32s	Microsoft Corporation
WinG	Microsoft Corporation
WinZip 6.3 (16-bit)	Nico Mak Computing Inc.
WinZip 6.3 (32-bit)	Nico Mak Computing Inc.
System	
ACDSee 16	ACD Systems
ACDSee 32	ACD Systems
DirectX 5.0 Runtime	Microsoft Corporation
DirectX Control Panel	Microsoft Corporation
DiscPlay 4.0.4	Obvion
Glide 2.43 Runtime	3Dfx Interactive
Norton Antivirus 95	Symantec
PC-cillin 95	Touchstone
PowerToys	Microsoft
Set Me Up 97	Omniquad
ToolBar Pro	Toolbar Software
Tweek for 3Dfx Cards	Benedict Walmisley
USB Support Patch	Microsoft Corporation
WinAmp 1.60	Nullsoft
ZipMan32	Helix
Utilities	
ClockMan95	Graphical Dynamics, Inc.
Cool Edit Pro	Syntrillium Software
Display Doctor 6.0	SciTech
GLQ+ for GLQuake	Bjoern Stensrud
Kremlin	Mach5 Software
Microangelo v2.1	Impact Software
Paint Shop Pro 4	JASC, Inc.
Painter 5.0	Metacreations
PhotoShop 4.0	Adobe
Premiere 4.2	Adobe
Sidekick 98	Starfish Software
Transfer 95	ITS Systems

NUGGETS

Micropolis Files for Bankruptcy; Seagate and Quantum Suffering

MICROPOLIS
1976-1997
R.I.P.

Micropolis's Board of Directors has decided to close the company. This decision was made after a thorough and comprehensive review of the company's financial position and market condition. Dr Joe Chen, CEO Micropolis, explained, "When we entered the market in early 1996, there were only four players, including ourselves, in the high-end disk drive market. Today, there are at least seven, some of whom are very aggressive. This has led to excess capacity and severe price erosion for the industry. It no longer makes any commercial sense for us to continue." As a result, Singapore Technologies, the parent company of Micropolis (a wholly owned subsidiary) filed for bankruptcy protection in Los Angeles bankruptcy court. The message on their answering machine confirms this by stating, "Singapore Technologies has decided to exit the disk drive business and all operations of Micropolis have ceased. The intent of Micropolis is to quickly liquidate all its assets and resolve the claims of its creditors."

Founded in 1976, Micropolis was a leading designer and producer of high-end hard disk drives with operations in Singapore, Thailand, USA, and Europe. It was known for its AV line of drives that delivered a steady stream of data for high-end video and audio applications. Its 4GB Stinger (featured in *boot*'s Dream Machine 97) and 18GB Tomahawk drive will be sorely missed.

But with increased competition, shrinking profits, and stockpiling inventories, other companies—including Seagate and Quantum—are also getting severely battered. Quantum has announced it won't be able to meet Wall Street's projected earnings, and Seagate, citing "significant overhead and lower margins," is shutting down its manufacturing operations in Ireland, displacing more than 1,100 full-time and 300 part-time jobs.

Microsoft's IE 4.0 Browser Update Available

Microsoft has posted an update to *Internet Explorer 4.0* that addresses some of the security issues and bugs that have cropped up in the past few months, and adds accessibility features that weren't included in the initial release.

IE 4.01's accessibility features give better control over how web pages are displayed on the client side. Users can now turn off colored backgrounds and ignore the font specified by a web page by forcing the same font and point size for all text.

Incorporated into *IE 4.01* are all the security fixes Microsoft has previously posted, such as the buffer-overrun bug that lets harmful web content crash a system, and the text-viewing bug that allows access to certain types of information from a user's hard drive.

Expect more updates in the future, as *IE 4.0* continues to ripen.

> 16

Microsoft Supports OpenGL

IT AIN'T WHAT YOU THINK

When Microsoft announced it would finally support OpenGL development (via a still-in-development OpenGL 3D DDK) across a variety of its platforms—including the forthcoming Windows 98 and NT 5.0 operating systems—the software world breathed a collective sigh. But was the decision (and subsequent implementation of a new certification testing and logo-branding program) somehow a sign that the DirectX team was finally conceding to those vocal, pesky game developers? Says Kevin Dallas, group product manager for graphics and multimedia at Microsoft, "absolutely not."

"It [the announcement] really just clarifies how to license, develop, and certify OpenGL drivers on the Windows platform," said Dallas. "Both Microsoft and SGI are now making it really clear to developers which API they should use for games, and that API has been, and still is, Direct3D."

Both Dallas and SGI's Sean Hopwood told *boot* that the two companies believe OpenGL is better suited for nongaming 3D applications—such as CAD/CAM programs—and when prompted, Dallas reiterated that Microsoft has "no plans whatsoever to abandon Direct3D." He also confirmed that Microsoft currently "is not planning to distribute OpenGL support with current or future versions of DirectX."

Which doesn't surprise Alex St. John, current *boot* columnist and former Microsoft evangelist. "This [announcement] is really just an agreement to do nothing," retorts St. John. "OpenGL is best suited for high-end applications, not because it couldn't be practical for games, but because Microsoft isn't going to make it practical for games."

St. John claims that OpenGL support had always been planned for both Win95 and WinNT. "The only thing notable about the announcement," said St. John, "was the fact that Microsoft was finally able to get SGI to agree to support its entrenched position that OpenGL is targeted at professional rendering applications only."

So with Microsoft still pushing D3D, what do game developers think of the announcement? Based on a random sampling *boot* conducted, not much.

"We have already looked into OpenGL, and we'll continue looking into it as a solution," said Criterion Studios' Mike King. "But right now, and for the short-term future, Direct3D appears to be the best platform for games."

Still, it will take a while for the OpenGL support to actually materialize. According to Dallas, the OpenGL Installable Client Driver (ICD) won't be ready until sometime in early 1998 and that the actual DDK isn't expected until mid-1998. As such, many companies, including ATI and Rendition, are still plugging ahead in developing their own ICD's. Said Jay Eisenlohr, Rendition founder and current vice president of marketing, "since we prefer not being on anyone else's schedule, we'll continue with our own ICD, adding in extra features for our own technologies."

And that, according to Alex St. John, is part of the problem. With Microsoft announcing yet another 3D architecture, St. John reckons the whole thing will lead to a whole new level of busted OpenGL drivers and even more hardware compatibility labs' bureaucracies.

Which worries developers such as Simis' Jonathon Newth. "The sooner the industry focuses on the real problems both OpenGL and Direct3D face—namely the pace of change, variable feature sets, scalability, and consumer awareness," said Newth, "the better off we'll be."

Let the games begin. **b**

> With Microsoft still pushing **D3D**, what do game developers think of the announcement? Based on a random sampling, **not much**.

INTRODUCING SHOTGUN™ TECHNOLOGY FROM DIAMOND. *Hook up two modems to two ordinary phone lines for connection speeds up to 112K. Shotgun software maintains a fast, dependable Internet connection while working intelligently with your phone lines—it even releases your second phone line for other uses.*

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NUGGETS

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DSL Technology to Offer Crazy Net Throughput—But for Whom?

A new bad-ass giznoid has joined the Digital Subscriber Line family. It's called VDSL (Very High Bit-Rate Digital Subscriber Line), offering a whopping 52Mbps over regular-old copper, and coming correct from the people at Siemens Public Communication Networks Group and Orckit Communications.

Compared to ADSL, another rising DSL technology that offers 8Mbps, VDSL is just plain bombastic. But with VDSL, you only get top performance in loops of 1,000 feet or less, meaning it's only a killer technology for high-tech businesses in close proximity to telcos' central offices.

Siemens and Orckit say VDSL will be ready sometime next year for those telcos that want to gamble on this latest DSL dandy. Just don't sell your 56.6Kbps modem quite yet—all DSL technologies will be slow to evolve since they require equipment upgrades for telcos that already like the profits they're earning from thriving T1 services.

Dueling Modem Camps Hash Out Differences

While the International Telecommunications Union must still ratify a final standard, a unified 56.6Kbps modem spec is much closer to reality following agreements reached by Rockwell Semiconductor and 3Com, antagonists in the seemingly never-ending modem standards war.

In a closed-door ITU meeting last week, a group of 25 modem manufacturers proposed a unified standard that borrowed from both 3Com's x2 and Rockwell's K56flex technologies. While neither 3Com nor Rockwell attended the meeting, the two power players agreed on two straggling technical issues addressed by the ITU proposal, and thus the unified spec finally congealed.

The ITU is expected to make an official spec proposal by February 6, 1998, and ratification could happen in September 1998. 3Com has stated that all its x2 modems can be upgraded to the unified standard with a software upgrade. No news yet from the K56flex camp as to whether its users will be able to employ a simple software upgrade.

Toshiba Kills Off Its Infinia Line

If you were waiting to purchase a Toshiba Infinia system, you'd better act fast. The company is abandoning the high-end desktop PC market to concentrate on the profit-rich sub-$1,000 and business markets instead. As a result, the Infinia line of PCs is now dead.

The entire existing line of Infinia PCs—including the studly Pentium II 266MHz-equipped 7260 model (reviewed in *boot* 17)—will be sold off. No other system refreshes are planned.

Toshiba's decision to ditch the high-end market comes at a time when direct mail-order sales are flourishing. Thanks to the successes of such mail-order stalwarts as Dell, Micron, and Gateway 2000, many retail-dependent

17 >

Attack of the Comdex '97

The bootBoys are usually chained to their desks, whipped like dogs by Big Daddy, (boot's bulked up, meat-eating, editor in chief), in a valiant attempt to churn out another page-busting issue. But once a year, they're let loose for one week in the most sinful place of all—Comdex—only to be forced to walk the streets (er… show floor) in the hopes of uncovering even more heart-stopping technology. NDAs be dammed (only kidding Intel)—here's the skinny.

Chips, Chips, and More Chips

A line's been drawn in the silicon sand, as processor arch-rivals AMD and Intel squared off to see who's got the fastest CPU. As Intel's colorful Bunnymen shook their Pentium II groove thang (invoking much nausea in the bootBoyz), AMD showcased its forthcoming K6+3D processor behind closed doors. With a little help from DreamWorks' *Trespasser*, AMD pitted its 300MHz K6+3D against Intel's Pentium II 300MHz, and thanks to some optimizing by DreamWorks' staffers, the K6+3D was able to run circles around the P-II part. By setting *Trespasser* to optimize itself for 15fps, the game ran at 512x384 for the K6+3D, as opposed to the blocky 320x240 the P-II mustered. Cleaner fogging and better alpha transparencies were apparent on the AMD side. Outside, for the rest of those "guests," AMD showcased its 100MHz system bus part and AGP on Socket 7. Current underdog Cyrix, meanwhile, was extolling the virtues of its Media Center—a cost-effective PC solution centering on its forthcoming MediaGX MMX CPU and VideoLogic's PowerVR 3D accelerator integrated on the motherboard.

Panasonic was doing live video feed via a Firewire video camera directly to DVD, proving that its new DVD-RAM drive was really operational.

As expected, motherboard mayhem ensued, with manufacturers such as Tyan, FIC, EpOX, and Abit readying Socket 7/AGP mainboards using VIA's VP3 or SiS's core-logic AGPset. Still, the majority of vendors will probably side with Intel's Slot 1 regime, with the ATX form factor becoming even more prevalent.

Gun Fight in the 3D Corral

3D accelerator manufacturers were also duking it out, with 3Dfx's much-anticipated Voodoo2 showcasing extreme frame rates and massive developer and OEM support (Creative Labs, Guillemot, Jazz Multimedia, and others have all announced plans for a Voodoo 2 part). Not to be outdone, NEC had mucho software running on its PowerVR PCX-2 chip, including Shiny's *Messiah* and Epic MegaGames' *Unreal*. Meanwhile, nVidia unveiled its roadmap for its next-generation part, but we'd be shot if we told you anything about it Banshee killer (oops). TriTech showcased its Pyramid3D accelerator on a variety of D3D games (including Rage Software's *Incoming*), but frame rates weren't as slick as expected. Oak had its WARP 5 3D processor up and running, comparing visual quality against 3Dfx's Voodoo and showing its full-screen anti-aliasing on Eidos' *Tomb Raider II* and LucasArts' *Jedi Knight* (which ran at a comfortable 20fps to 40fps on a P-II 300MHz machine).

Ditch the Disk, and Make the Switch

A new rewritable DVD format, appropriately called DVD+RW (as first reported in *boot* 15), had its first public demonstration at Comdex. The six companies involved in the demonstration are all familiar faces to the CD-R world—Hewlett-Packard, Mitsubishi, Philips, Ricoh, Sony, and Yamaha—and were also part of the DVD Forum that approved the original, but largely abandoned (save for Hitachi, Panasonic, and Toshiba), DVD-RAM spec. Both DVD+RW and DVD-RAM use similar phase-change technologies to write and rewrite data to disc, but since DVD+RW uses the same contiguous block architecture as DVD-ROM, it guarantees backward compatibility with CD-ROM, CD-R, and CD-RW. DVD+RW media will have a capacity of

D-500L
SYS.640
P-300
AL CAMERAS
OLYMPUS LENS AF ZOOM

Among the technologies being spotlighted at this year's Comdex was Olympus's D-600L digital camera (see review on page 45).

3GB per side, compared to DVD-RAM's 2.6GB and doesn't require a protective cartridge. The drives themselves will support both CAV and CLV and pull a sustained transfer rate of 1.7MB/sec.

The public demonstration involved copying a portion of the *Muppet Movie* to the new media running on a prototype DVD+RW drive. Video playback was then tested successfully, although DVD+RW's role as a digital video solution (supplanting traditional VCRs for example) was downplayed later during a Q&A session.

Hitachi, Panasonic, and Toshiba all showed working DVD-RAM drives and plan on shipping them in the first quarter of 98. But with DVD+RW's release targeted sometime in Q3/98, it appears DVD-RAM already has a big head start.

Bottleneck Banshees

Bandwidth, the biggest bottleneck on the PC, was literally blown wide open. The preeminent buzz was about Ultra 2 SCSI and from what we saw, there's no doubt it'll rule till the new millennium. Delivering bus potential twice that of Ultra Wide SCSI, Ultra 2's 80MB/sec had even the most tight-lipped PC phreaks drooling. Utilizing a new transceiver technology called LVD (Low-Voltage Differential), Ultra 2 lengthens the overall bus to 12 meters and allows up to 15 devices to be hooked up on a single channel. Adaptec, Diamond, and Seagate were all hot to show it in action. Adaptec was showing off its new 2940U2W Ultra 2 SCSI card with two Seagate Cheetah Ultra 2 drives hooked up to a 12-meter external cable wrapped around a 15-ft tower. Diamond used the same idea except with a 12-meter internal cable attaching its Fireport 80 Ultra 2 SCSI card to a Quantum Atlas Ultra 2 drive. And it all worked! (In reality though, with just two Ultra 2 devices, the cable length can be doubled again to 25 meters.) Seagate had the mother of all setups, though, as they attached 15 Cheetah and Barracuda Ultra 2 drives to a 12-meter cable, pumping a whopping 75MB to 80MB through the Ultra 2 SCSI bus. It was, shall we say, a sight to behold.

But the fun didn't stop there. Adaptec and Promise are finally offering workstation-level RAID cards, and all we can say is "It's about time!" Adaptec actually has two: one with SCSI on-board and one without (for use on motherboards with a built-in 2940 chip). Both offer data striping (RAID 0) for balls-out performance and mirroring (RAID 1) for applications requiring fault tolerance. Promise, on the other hand, takes the RAID thing to the IDE bus. It showed off the FastTrak disk accelerator that offers both the RAID types that Adaptec offers using IDE drives. And the card, like IDE drives, is cheap ($150) allowing you to connect up to four drives for a bus filling potential of 25MB/sec. And yes, you can even boot from it.

Why Ultra2 SCSI
Backward Compatible

Seagate maxed out the Ultra 2 SCSI bus with 15 Cheetah and Barracuda drives. Just imagine what you can do with 80MB/sec of throughput...

Low-Cost Marvels

And finally, if the thought of a sub-$1,000 PC makes you shudder in horror, like it does us, take heart. Many companies managed to jam a boat-load of components (including fast processors, video, and telephony features), into one neatly assembled package—small and innocuous enough to complement your living-room entertainment center. And we're not talking about those piddling NetPCs either. Products sporting Pentium/Socket 7 architectures included Cirrus Logic's Calysto set-top box, Micron's Fusion Theater, and Cyrix's Media Center, all of which will be making their debut sometime in 1998.

NUGGETS

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companies—including Compaq and NEC/Packard Bell—have killed off their high-end products (the Presario 7000/8000 series and NEC's PowerPlayer line have bit the dust) to concentrate on new build-to-order paradigms, citing lagging sales and lackluster profit margins.

Quantum3D to Do Voodoo2; Announces Trade-In Offer

Quantum3D has announced plans for a Voodoo 2–based graphics board, code-named "Obsidian 2." The second generation of Quantum3D's Obsidian family of real-time 3D graphics accelerators will employ advanced configurations of the Voodoo 2 chipset to achieve new levels of absolute 3D performance as well as maintain the Obsidian family's industry-wide lead in real-time 3D price/performance. Targeted for volume shipment by mid-1998, the Obsidian 2 products are being designed to compliment Quantum3D's current Obsidian product family.

"Our current 100SB provides a great preview of what Voodoo 2 portends—which is simply unparalleled real-time 3D performance," said Quantum3D vice president and 3Dfx founder, Ross Smith. "The 100SB's parallel Voodoo 1 chipset implementation produces about 2.4GB/sec of dedicated 3D graphics bandwidth—which is about the same as the 2.2GB/sec that a two texelfx Voodoo 2 implementation will produce. And of course, this performance hasn't been lost on a number of affluent *Quake* fans who want to dispatch their opponents at frame rates and resolutions that their less fortunate friends will only get to experience in HyperWare's Obsidian-equipped arcade systems or on consumer-level graphics boards sometime next summer."

And in an unprecedented move to protect customers' investments in Obsidian and Voodoo graphics technology, Quantum3D also announced it is implementing a "trade-in" program. If you've already purchased a consumer-level Voodoo Graphics–based board or entry-level (and/or mid-range Obsidian series products), Quantum 3D will allow you to trade 'em in for a more advanced Obsidian real-time 3D graphics accelerator. Owners of Obsidian 50-2200, 50-2220, 50-4220, 50-4440, Diamond Multimedia Monster 3D, Orchid Righteous3D, or other competitive "3D-only" Voodoo Graphics–based products will be eligible to receive as much as a $200 rebate when they trade in their board(s) toward the purchase of Obsidian3DS or Obsidian 100SB series products. In addition, Quantum3D announced it would be implementing a similar trade-in option for customers who desire the new Voodoo 2–based Obsidian 2 real-time 3D graphics accelerator. Further information on the current trade in program offer will be posted on the Quantum3D web site (www.quantum3d.com).

Details of the Obsidian 2 trade-in program will be announced in early 1998, concurrent with the announcement of the commercial availability of the Obsidian2 product.

Havoline
maxell

3Dfx™ interactive

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COMPILED BY DAVID PESCOVITZ

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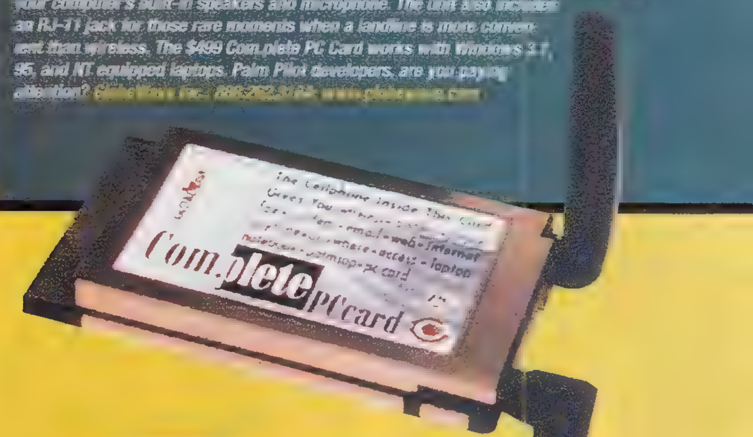

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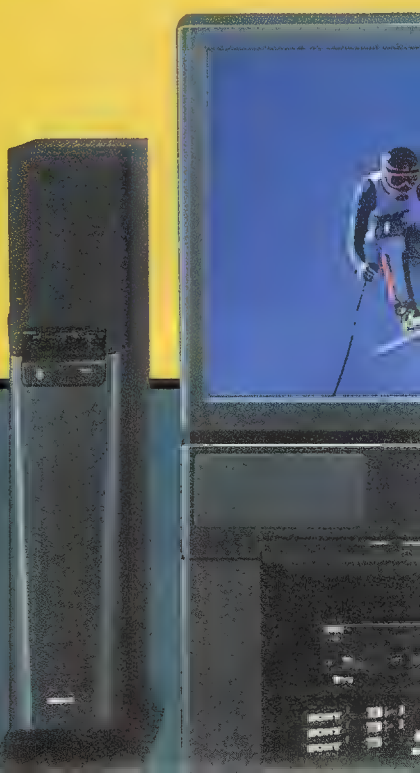
Portable Protection

Power surges are a problem for portable PCs, too. Don't let spikes in your hotel room wreak havoc on your road-warrior status. APC's SurgeArrest Notebook protector offers one-outlet AC protection, but doesn't ignore the danger of plugging your fax/modem into an unfriendly RJ-11 jack. The SurgeArrest Notebook features a 6-foot telephone cord with three phone jacks for convenient protection. Simply plug your modem and the hotel phone into the device, and you won't have to move furniture between every voice and data call. For $29.95, the SurgeArrest Notebook has a lifetime warranty and APC's famous $3,500 three-year Equipment Protection Policy. American Power Conversion; 800.877.4080; www.apcc.com



Point And Click PDA

Sharp's HC-4500 Mobilon PDA combines the power of a Windows CE PDA with an optional digital camera for multimedia in your pocket. First, the Mobilon itself: 6.5-inch LCD touch screen with backlight, 8MB of memory (internally upgradable), built-in 33.6Kbps fax/modem, voice memo recorder, and plenty of Microsoft software jammed into the 7.3x 3.7x1.2-inch, 17.3oz body. Now the camera: 640x480 resolution with a 2x optical and 2x digital zoom that attaches to the side of the Mobilon. The Mobilon will retail for approximately $900. (Black and white models available for less.) Add the camera for less than $400, and the Docking Station Kit so you can sync for around $150. Then hit the machomedia trail. Sharp; 800.237.4277; www.sharp-usa.com

CommPlete
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Bonded For Speed Bring your ISP up to speed. Multi-Tech Systems is hyping 92Kbps over two analog phone lines using its CommPlete Communications Server product with Lucent Technologies' K56flex chips, and using Multi-Tech's own ML-PPP software. The technique is called "Channel Bonding," where the data stream is split in half on the server side and carried over separate phone lines. The user employs any two K56flex modems and Dial Up Networking software to stream the signals into the box where they're merged. If you're an ISP, the price for the CommPlete is as low as $189 per port. Multi-Tech Systems; 800.328.9717; www.multitech.com

GPS III
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Be Here Now Always ahead of the curve in GPS gadgets, GARMIN International has a new entry—the handheld GPS III. Handheld and weighing only 9 ounces, the $571.80 GPS III not only computes your position on its comprehensive digital maps, but tracks your route, "leaving a breadcrumb trail showing every twist and turn." Annotate your path with icons and brief descriptions so you'll never forget how to get back to that beautiful rock formation or roadside fruit stand. The ingenious through-the-windshield view of the 3D Virtual Highway Page shows you where you are in relation to nearby significant locations shown as signposts on the side of the virtual highway—just like a driving videogame, only once you get there, there you are. GARMIN International; 888.442.7646; www.garmin.com

Mobile Answering Machine Years ago, before text messaging, you could call a number and leave a voice message that would be transmitted directly to someone's pager (usually a doctor or plumber). In that spirit, Motorola unveils its $185 advanced voice pager/portable answering machine (its brand name depends on which service provider you buy it from). Leave a voice message for the person you want to page and it is stored in the palm-size unit for playback at the user's convenience. Simple to use—with play, rewind, fast forward, pause, lock, and delete buttons—the device holds up to four minutes of voice messages internally, while an infinite number can be held in the paging network's system. Motorola; 800.548.9954; www.motorola.com

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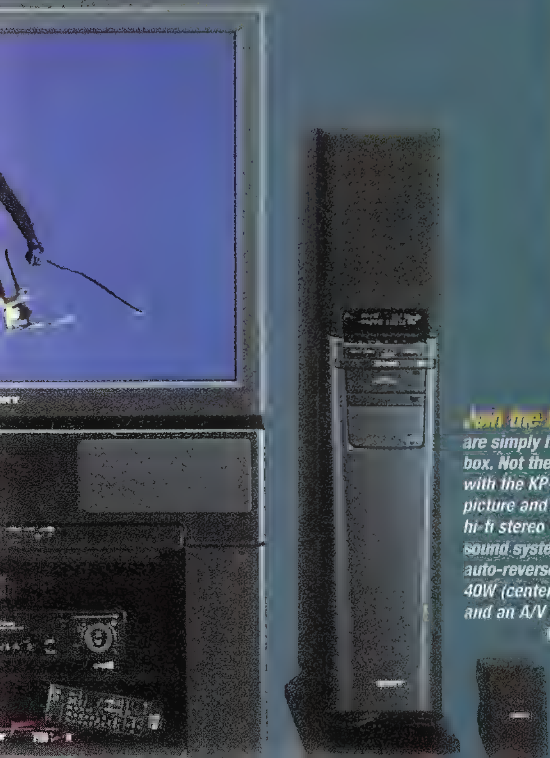

Join the A/V crew Too often, all-in-one home theater packages are simply half-rate components packed neatly into one low-priced box. Not the Sony MXT-4135 Maximum Television system, complete with the KP-41T35 41-inch big screen TV with two-tuner picture-in-picture and a three-line digital comb filter; the SLV-795HF four-head hi-fi stereo VCR with VCR-Plus+ and a cable mouse; SA-VA100 MAXTV sound system, which includes tuner, seven-disc stacking CD changer, auto-reverse cassette deck, and five-channel amp with 35W (front) and 40W (center and surround) power; seven speakers in four cabinets; and an A/V cabinet that keeps everything tidy and sleek. How much for the whole shebang? Only $1,200. Going once, going twice... Sony Electronics; 800.222.7669; www.sony.com

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- 16:10 aspect ratio
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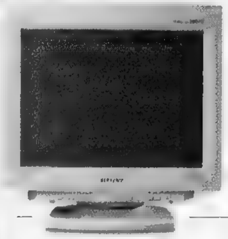
21" CRT 500PS



- 19.8" viewable image size
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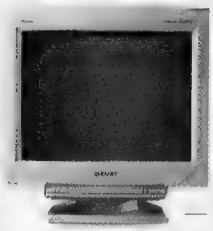
- Resolutions over 1600 x 1200 @ 85Hz
- Enhanced Elliptical Correction System technology
- Active Signal Correction (ASC) technology
- Dual input capability
- Short neck CRT design for reduced cabinet depth
- Designed for Windows NT® and Windows® 95
- 3-year limited warranty for parts, labor and CRT

21" CRT [illegible]



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- 0.25 aperture grille pitch
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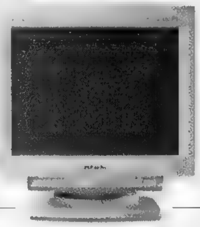
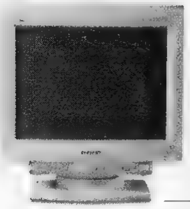
19" CRT 400*PS*



- 18" viewable image size
- 40-50% flatter Trinitron CRT†
- Enhanced Elliptical Correction System technology improves beam spot shape over 35%**
- Active Signal Correction (ASC) technology
- Dual input capability
- Designed for Windows NT and Windows 95

17" CRT 200*PS*



- 16" viewable image size
- Elliptical Correction System™ technology improves beam spot shape up to 35%**
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- 3-year limited warranty for parts, labor and CRT
- Designed for Windows NT and Windows 95

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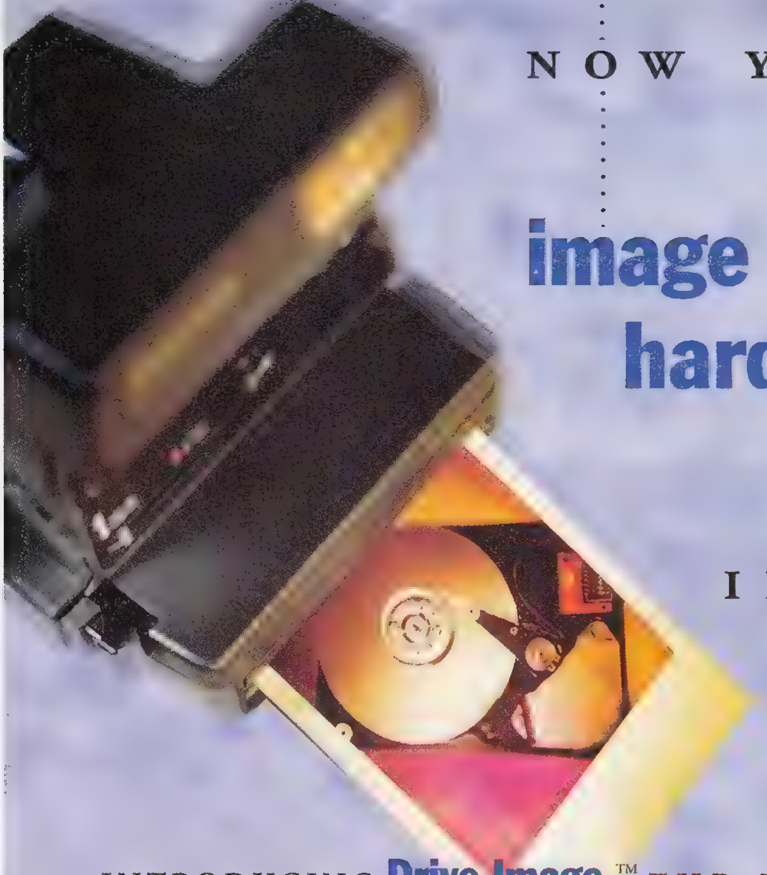
*VIS stands for viewable image size. **Over last year's model. †Sony's new 19" and 21" CRT technology is 40-50% flatter than traditional aperture grille and FST CRTs. Specifications are subject to change without notice. Windows and Windows NT are registered trademarks of Microsoft Corporation. SOD S-19



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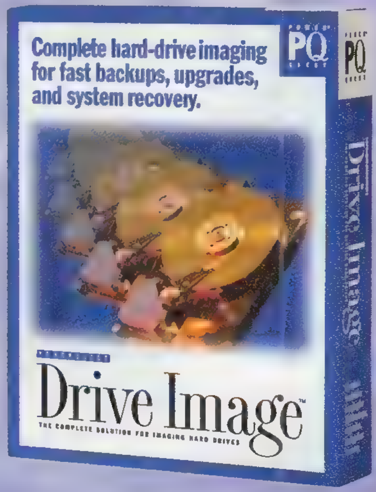
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Product Information Number 281

THE SAINT

WITH ALEX ST. JOHN

Blueprint for the DreamOS

IMAGINE AN **OS** THAT ADDRESSES ALL THE **FAULTS** IN **WINDOWS**... THE SAINT CAN!

ALEX ST. JOHN From his position as Microsoft's game technology evangelist, Alex St. John was responsible for the controversial DirectX APIs that have either taken PC gaming to the next level or were horribly broken, depending on your point of view.

Last month I ranted about just how badly Windows is busted. This month, I'll quit bellyaching and offer my high-level overview for a consumer operating system that overcomes those limitations.

What can a consumer OS learn from stable, mature, proven consumer platforms such as consoles, TVs, VCRs, CD players, and toasters?

It should be dedicated to doing one thing well. Neither the user nor the content should ever have the opportunity to damage the system. A screwdriver should never be necessary for upgrading. There should be fully integrated solutions with only one layer of indirection between the platform and the content.

To build a DreamOS, you first need to characterize your users. Mine spend 50% of their computing hours—you guessed it—playing games. This is punctuated by occasional bouts of productivity running *Word, Excel, Quicken,* utility software, and maybe an Internet browser.

DirectOS would be a dedicated operating system composed of a real-time event scheduler that can't be blocked for more than a few milliseconds, by *anything.* Any driver that can't get the job done in less than 10ms will be deemed broken. The standard OS would be just a kernel, a memory manager, a driver to load other modules from an external device, a registry characterizing its current hardware configuration and performance characteristics, and a default set of drivers for the existing hardware. All higher-level OS services should be carried around by the applications that use them and loaded as part of the application, which is responsible for bundling all its own OS services.

> DirectOS would be composed of a real-time event scheduler that **can't be blocked for more than a few milliseconds**. Any driver that can't get the job done in less than 10ms will be deemed broken.

The operating system would run only one "master application" at a time. The master application is the foreground application and has priority over nearly all system resources. Background applications—either drivers on a tight real-time leash or programs sitting in memory—would get no CPU cycles without permission from the master application.

A DirectOS master application would ship with a complete set of OS drivers. No other drivers or applications would compete with the master application for access to the systems resources.

And since every app carries its own system components, it also knows what parts to load and when. Using this information, master applications would ship in a format that allows very fast load times with minimal initialization. Each master application would ship with three fast-loading images of itself: a first-time image, a common-usage foreground image, and an idle-mode background image. Master applications would surrender their position when the user launches another application, which would then either allocate a fixed memory partition for the old master app or throw it out of memory completely. Thus, fast-loading apps replace preemptive multitasking.

These apps could be converted from the existing installed base of Windows apps with a simple utility, since DirectOS apps would use Windows APIs. But with DirectOS, they'd all carry the needed OS components, rather than expect to find them all pre-installed and working on the host machine.

The file system would be treated as a temporary app cache. Any information a master application needs to load should be completely hidden from the user, entirely self-contained from other apps, and easily discarded with no dire consequences to anything else in the system. Only documents would be accessible to the user.

All files would effectively have their own partition. Any one application could be completely purged with no ill effects to the system. A hidden "virtual partition" would exist to store rigorously defined persistent state information about each application and user preferences. It would include information about previous installations, last-usage time, documents associated with the application, and so forth.

DirectOS would also feature greater stability, because applications would use only drivers they've been tested with. And breakages resulting from application and driver collisions are eliminated, resulting in a net reduction of total code needed to run any given application. This also allows tons of bureaucracy-management code to be removed from the system. And if something *does* go bang, it's very easy to figure out what happened.

Overall, the file system becomes idiot proof. It may become fatter under some circumstances, but it's also quicker to purge. Garbage accumulation is eliminated or at least confined to known boundaries.

Because user profiles and information are rigorously defined and contained, it would be easy to replicate a user's complete configuration on another machine.

The thing I like best about DirectOS is that it's actually not much work to create. It's not a big departure for existing PCs. In fact, Microsoft even has an OS that could be altered to fit the bill, if it just had a change in perspective about it.

Maybe somebody will show this article to the Windows CE guys. ▯

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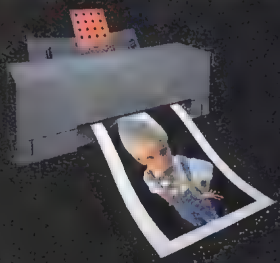

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WITH T. LIAM McDONALD

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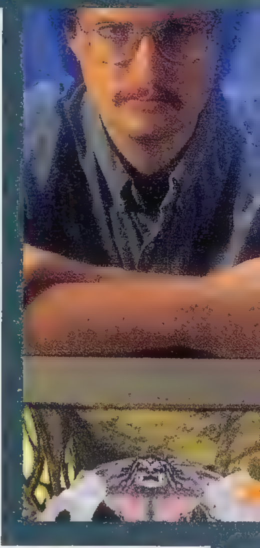


T. LIAM MCDONALD is the all-knowing god of gaming. His mother still can't believe that he plays games for a living.

A recent review I wrote caused a stir among some game fans. In the ensuing debate, I was cast as either hero or villain, depending on whether you agreed or disagreed, but I started wondering about the criteria that went into evaluating a game's relative success or failure.

The game in question was Microsoft's much-ballyhooed *Age of Empires*. There's much to enjoy in this *WarCraft* clone, but it fails on several key points—such as unit AI and pathfinding. I criticized the game not for what it was but for what it was not, based on what the hype machine, the ads, and the box itself had led me to expect. Is this legit? Let's look at some recent cases.

Age of Empires was pitched as *Civilization* meets *WarCraft*. In other words: a real-time game with elements of conquest and empire-building. In fact, the game's tag reads "An Epic Game of Empire-building and Conquest." The box blurb speaks of "accumulating wealth" and "building a great civilization." A picture on the back shows troops arrayed in neat rank and file, as if poised to execute some complex tactical maneuver.

Now, there are empire-building games and there are real-time strategy games. *Civilization*, *Conquest of the New World*, and *Imperialism* are empire-builders. *WarCraft*, *Dark Reign*, and *Total Annihilation* are real-time strategy games. *Seven Kingdoms* is both. "Empire-building," in my mind, implies finding a balance among the military, diplomatic, economic, and welfare issues facing your virtual people as you conquer other virtual countries. Conquest games involve harvesting resources, building an army, and smacking the hell out of a neighbor.

> A sim doesn't *need* to be realistic to be fun. However, when a publisher goes after the **niche that *demands* realism** by making claims of realism, it *must* be judged on those claims.

The problem is that *Age of Empires* has no real economic model, diplomacy is reduced to its simplest forms, and the happiness of your people matters not one jot. And the picture of troops arrayed for battle is a joke, since there's practically no way to do this in the game.

All we're left with is a last-gen *WarCraft* in togas: entertaining, but hardly a true empire-building game. And it has none of the recent crop of *WarCraft* clones' innovations (such as the AI and pathing controls of *Dark Reign*). So, I gave it a middling review.

While the definition of "empire-building" might be debated, the factors that make a flight sim "realistic" cannot, which leads to my second example.

When a flight or racing sim crosses my desk, I read the box and supporting material closely to see what the publisher is aiming for. Buzzwords such as "realistic," "accurate," and "real-life physics" get my antennae rotating. A sim doesn't *need* to be realistic to be fun. Plenty of people just want to fly or drive without fuss. However, when a publisher goes after the niche that *demands* realism by making claims of realism, it *must* be judged on those claims.

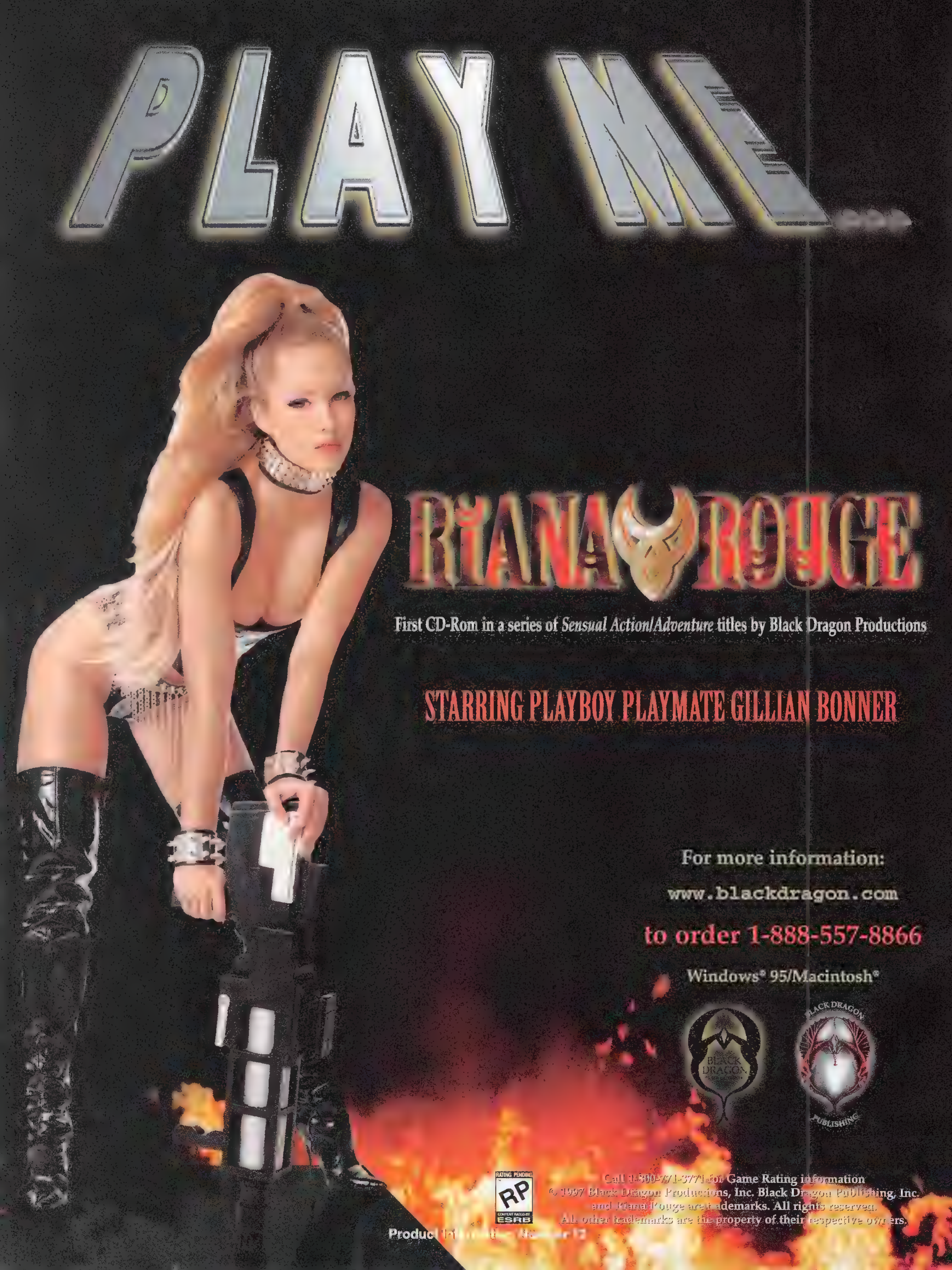
Some things are immutable, such as the laws of physics. Planes have long, nondebatable records detailing how they respond under specific situations. If a sim doesn't follow these rules, then claims of realism are untrue. Accordingly, when I saw that *Sabre Ace* featured "superior aerodynamics and accurate plane physics," I tore it to shreds, despite the fact that it had some entertaining arcade-like elements.

There's a point where the factors that make for a good game go from being matters of subjective opinion to matters of cold, hard fact. A movie critic or book reviewer can say that something is the "feel-good movie/book of the year," and you may agree or disagree. But when someone sits down to review a new 3D accelerator card or a stereo, subjective opinion yields to empirical fact. Either the card has 6MB of EDO RAM or it doesn't. Either the stereo has a subwoofer or it doesn't. There is no room for debate.

It's the same with games. There's a point where the reviewer must deal with real-world claims. Does a football game accurately simulate a season or are the stats wrong? Does a wargame give accurate values to an M1A2 Abrams tank, or is it easily killed by infantry? Does an airplane stall or spin under certain conditions, or does it defy the laws of physics. It may be fun, but is it *right*? And, just as important, is it *supposed* to be right?

I can see where someone who doesn't share my definition of an empire-building game could find fault with my review of *Age of Empires*. That's partially a matter of expectations. But with something like a flight simulator, there's less room for debate, especially when claims are patently false.

If you buy a new computer because the box says it's a P200 with 32MB of RAM and it turns out to be a 486/33 with 8MB of RAM, that is consumer fraud. If you buy a flight simulator because the box claims it has "real-world physics," and it does not, is that not also fraud? Software publishers are not immune to these accusations. They have to make sure the product they hype is the same as the product they sell. And when they don't, they need to be called on it.



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Product Information Number 17

ON THE LINE

WITH SHEL KIMEN

Spam **Bit** Me **Hard**

IT'S **NEVER** TOO **LATE** TO **FIGHT BACK**

To my credit, or discredit, I've a habit of ignoring hype. I don't watch *Friends*, I don't shop at Gap, and Alanis Morrissette is strictly off-limits. However, I also didn't think carpal tunnel *really* hurt, and I didn't think spam was that much of a problem...

Whoops. My wrist *still* aches, and I'm pissed at my local ISP.

Recently, I tried to send e-mail from work via T1 and POP3. No luck. For five whole days, I tried without luck. My incoming mail was fine, but outgoing simply wasn't. I finally called the service and asked why.

"We closed our public SMTP server."

Huh? The technical service dude explained that because certain spammers were using its mail servers to send bulk annoyance through the Internet, the company closed its public mail server and initiated a mandatory dial-in-to-send-out policy. It took me a few days to locate another public mail server (by the way, they're dwindling because of this very reason). Problem solved, albeit temporarily, but bitterness resides.

Spam bit me.

Because I often switch ISPs, I've never had a problem with advertising. To me, spam was nonexistent—until I got my own domain. Since then, I've landed on a plethora of bulk lists. I finally got enough of these gadflies to inspire some research and—lo and behold—spam *is* a huge problem. Maybe I should've believed the hype and gotten on the anti-spam bandwagon sooner. But now that I'm aware, apathy will not be tolerated.

The Netcitizens Protection Act of 1997 would allow consumers to **sue offending companies up to $500** for each piece of unsolicited advertising e-mail.

Perusing the net for spam info, I found this agonizing tale of some poor guy's woes against spammers: "A mad mail-bomber from Hong Kong sent me *100,000* messages in one weekend using four computers at a time..." In four days, he received so many messages that four of his mail accounts collapsed. "61MB of junk erased, and the Hong Kong ISPs still take no action." (Read more at **www.geocities.com/CapitolHill/4353/bomb.htm**).

Another source of spam news is Junkbusters.com. The web site has dozens of stories about how spam hurts, annoys, and invades privacy. I learned there that many mail list brokers are giving K-12 students free e-mail accounts in exchange for their names on bulk mailing lists. (*Tres* uncool!)

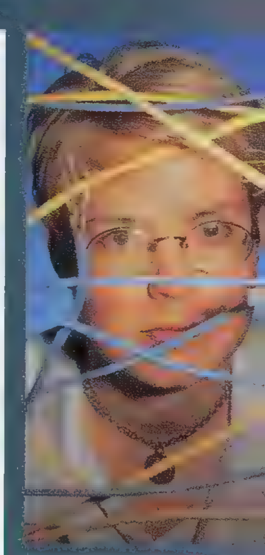
Since January '97, state legislators have been initiating bills against spam. The first was signed in July '97. Unfortunately this wasn't tough enough, according to most anti-spam proponents. The law states that bulk e-mailers must offer a removal procedure for recipients and requires all senders to use correct business names on all mail, and that's it. No fines and no penalties. Several other states have initiated laws with more muscle, including Colorado House Bill 1284, Connecticut HB 6558, Maryland HB 778, and Massachusetts HB 4581.

However, as these anti-spam initiatives gain media attention, direct marketers are fighting back. One such group, using the domain onlinebiz.net, has built a site advocating the rights of online marketers. The site targets "a small, yet very vocal faction of anti-commercialist fanatics wishing to stop Direct Marketing conducted through the Internet. They have resorted to attacks, fraudulent claims, electronic terrorism, harassment, etc..." It goes on to actively oppose The Netcitizens Protection Act of 1997, which would allow consumers to sue offending companies up to $500 for each piece of unsolicited advertising e-mail, and up to $1,500 per message if it can be proven that the company "willfully" or "knowingly" violated the law.

But just as bazillions of spammers are running loose on the Internet, bazillions of online resources are available to help you fight spammers.

The especially bitter should visit the Fight Back web site (**www.ecst.csuchico.edu/~atman/ spam/**) for a list of spamming companies and their 800 numbers. (Companies get charged on a per call basis for having an 800 number. So go ahead... leave a message!)

If you're less vengeful and just looking for legal advice, mail filtering help, or some snazzy scripts to ward off potential evildoers, check out Spam-Sucking Slimeballs at **pw2.netcom.com/~rrhain/html/spammer.html**. It's a good list of userids and addresses of the companies and organizations that spam.



SHEL KIMEN is traveling the world (real time, not virtually), so e-mail response may be slower. But as always, try her at kimen@well.com.

"The Anti-Spam How-To: A guide on tracking down and nailing the senders of unsolicited advertisements" (**zikzak.zikzak.net/~acb/features/anti-spam-howto.html**) has solid advice, as well as instructions on running tracers and searching headers to track down the true source of junk mail.

Some Internet users are taking the lack-of-law into their own hands. A San Diego engineer offered a $100 reward to anyone who could help locate the parties using his domain live.net as a reply-to address. Many spammers have taken to using fake reply-to addresses, and your domain could be one of them! Yikes!

Though it appeared that a major victory for anti-spammers was in sight, on September 30, 1997, a court ruling stated that the king of spam, Stanford "Spamford" Wallace, would be able to put his infamous Cyber Promotions back online (after being removed by backbone provider AGIS). The ruling, though offering itself only as a temporary solution, sets back months of legislation in the war against spam.

I now know I was wrong. Spamming is real. It's a significant problem, and you can stop it by writing your congresspeople and participating in one of the anti-spam communities online. Start with **newsgroup://news.admin.net-abuse.email.** b

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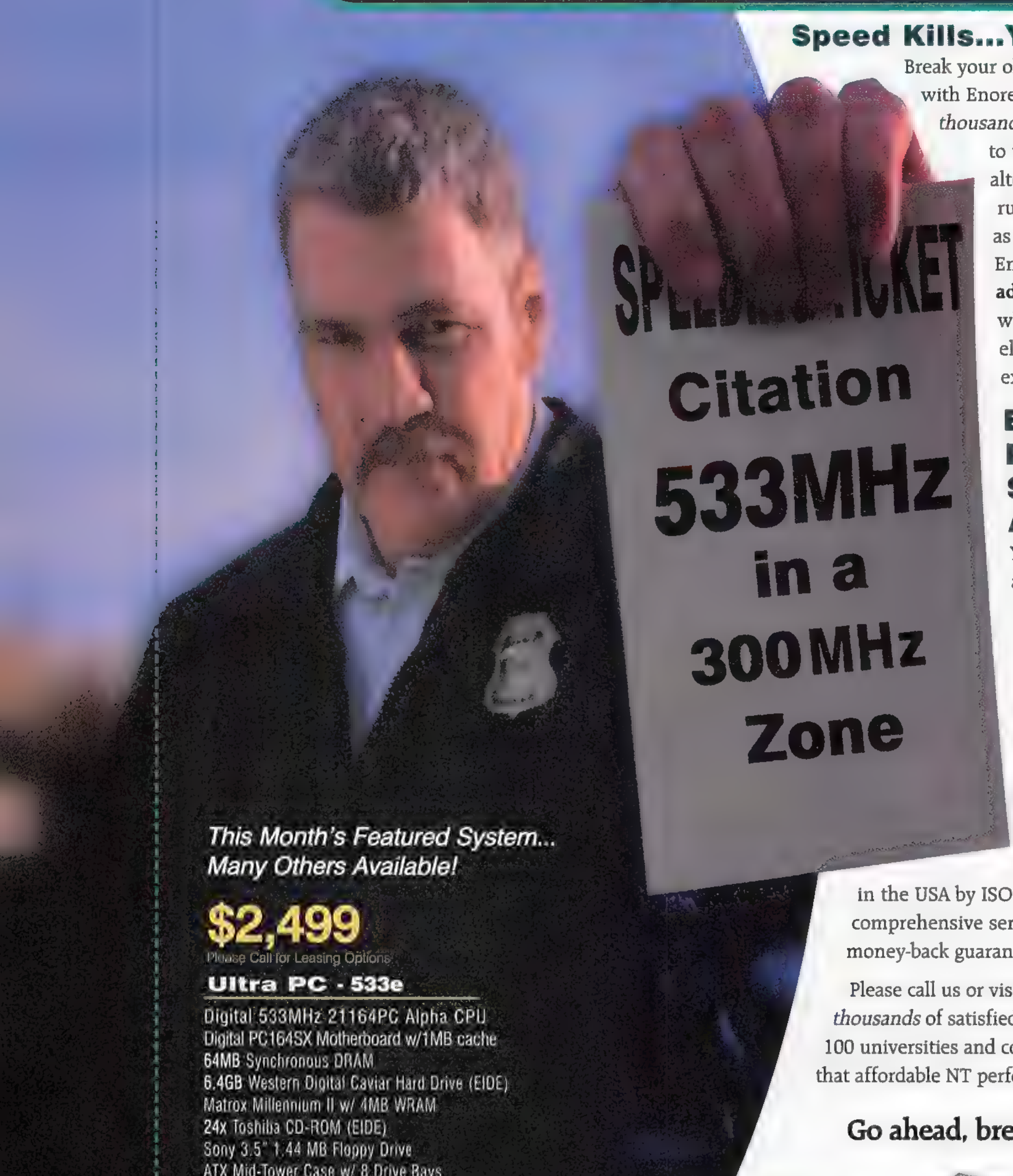

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FAST FORWARD

WITH TOM HALFHILL

The When-to-Buy **Blues**

SHOPPING FOR SOME SERIOUS **MUSCLE** IN THE COMING YEAR

Buying a new power computer is like paying blackmail: It buys you relief, but you know it won't be long before you'll have to shell out more cash to maintain your reputation.

Oh, sure, when you first buy a new muscle machine, you're flying high. The heavy tower looms tall and powerful on your desk. You show it off, brag about it, and load it up with software that would crush your old PC. Your friends are envious. Your colleagues turn to you for even *more* tech advice. Your family wonders where you got the money.

But enjoy it while you can because pretty soon... the machine just doesn't seem *quite* as fast. Maybe it was that last mammoth upgrade from Microsoft, or the latest 3D shooter. Then you hear that Intel has announced a marvelous new chip with stratospheric clock speeds. Some whiz-bang technology like MMX or DVD or USB comes along, and suddenly your computer is buzzword-challenged.

You can postpone the inevitable by upgrading a few components here and there. But a heart-transplant patient has never won an Olympic decathlon, and spare parts can take your PC only so far. To maintain your rep, it's not good enough to be merely ambulatory.

OK, so it's time for a new PC. Now you have to decide *what* to buy, and—even more worrisome—*when*. It would be just like Intel to announce a 747MHz superchip the day after you unpack and set up your new machine, reinstall your apps, copy all your files, customize the system settings, hide your credit card, and spam all your friends with e-mail bragging about your hot new 300MHz box. "Haw, haw!" they'll laugh cruelly. "Whatsamatter? Don't you read *boot*?"

> Deciding when to buy is especially hazardous right now, because so much new stuff is coming. If you buy a PC in the next 12 months, it's probably going to have an even **shorter-than-normal life span**.

Deciding when to buy is especially hazardous right now, because so much new stuff is coming. If you buy a PC in the next 12 months, it's probably going to have an even shorter-than-normal life span. You have to decide whether to stall for a year or resign yourself to becoming a hapless victim of planned obsolescence.

In the first half of 1998, Intel will introduce its 440BX system chipset, which will boost frontside bus speeds of Pentium II systems to 100MHz. Other chipset vendors and CPU makers are following suit. Except for a few machines that run at 75MHz—and the souped-up systems of adventurous overclockers—PCs have been stuck at 66MHz since 1993. At 100MHz, the bus will deliver 50 percent more peak bandwidth.

But do you really need 100MHz? It makes sense for servers and desktop PCs that do lots of CPU-intensive processing. It'll make even more sense when CPU core frequencies exceed 400MHz. Still, if you don't feel comfortable riding at the back of the bus, 100MHz will definitely be a status symbol in '98.

Meanwhile, SDRAM is starting to supplant EDO RAM. SDRAM costs more right now, and it's not spectacularly faster, but it still belongs on every power user's wish list. Then again, if you can afford to buy more EDO RAM, you'll almost certainly get better overall system performance than you would by having a smaller amount of SDRAM.

We're also seeing the first wave of PCs with AGP slots. But watch out—the first AGP systems don't implement the full AGP specification. The full spec, misleadingly called AGP-2x, actually improves the peak graphics bandwidth by a factor of 4x compared to PCI. It does this by doubling the data channel frequency to 66.6MHz and transferring two 32-bit packets during each clock cycle. That yields 533MB/sec, compared to PCI's 133MB/sec. Also, a well-designed AGP-2x channel carries its control signals on separate lines instead of multiplexing them with the data, and a well-designed AGP system chipset has a deep queue for caching memory requests from the graphics card. Early AGP implementations don't have any of those features. The so-called "baseline AGP" or AGP-1x solutions merely double the frequency to 66.6MHz. It's definitely faster than PCI. But AGP-1x should fade away by the end of the year, and all the dudes will have *real* AGP-2x.

TOM HALFHILL is a senior editor at *Byte* magazine and the author of two computing books. He first became interested in computers during the disco era.

In mid-1998, Intel will introduce Deschutes, a new Pentium II manufactured with 0.25-micron process technology. Initial clock speeds will likely be 350MHz to 400MHz. Intel will also roll out Slot 2, a new SEC interface. Slot 2 won't replace Slot 1, but it will allow larger SEC cartridges, which means larger Level 2 caches that can also run at full core speeds. Like the 100MHz frontside bus, Slot 2 is aimed mostly at servers and high-end systems. In fact, Slot 2 won't support bus frequencies below 100MHz.

But Slot 2 will be a power user's dream. Contrary to some reports, however, you won't have to buy a Slot 2 motherboard to use Deschutes. Intel will offer Deschutes in SEC cartridges for Slot 1, too. In a year or so, Deschutes will completely replace today's Klamath chips.

And if all that isn't enough to worry about, don't forget MMX2. This new extension to the x86 architecture will add instructions for floating-point math, and that means dramatically faster 3D graphics. You're almost sure to miss out on this feature if you buy an Intel-based PC in 1998. However, Intel's competitors will have their own answers to MMX2—and probably sooner, too.

If your PC is running like a crippled duck, you have to replace it. But if it's a borderline case, consider stuffing it with upgrades to keep it going just a little longer. For PCs, 1998 will be a year of transition.

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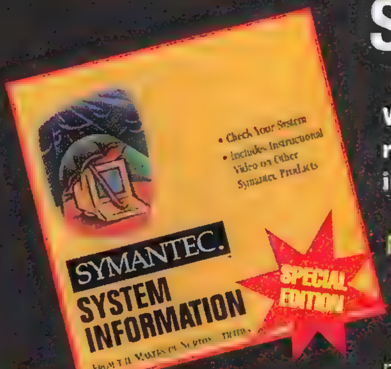
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the boot interview

3D Resur

PHOTOGRAPHY BY MARK MADEO

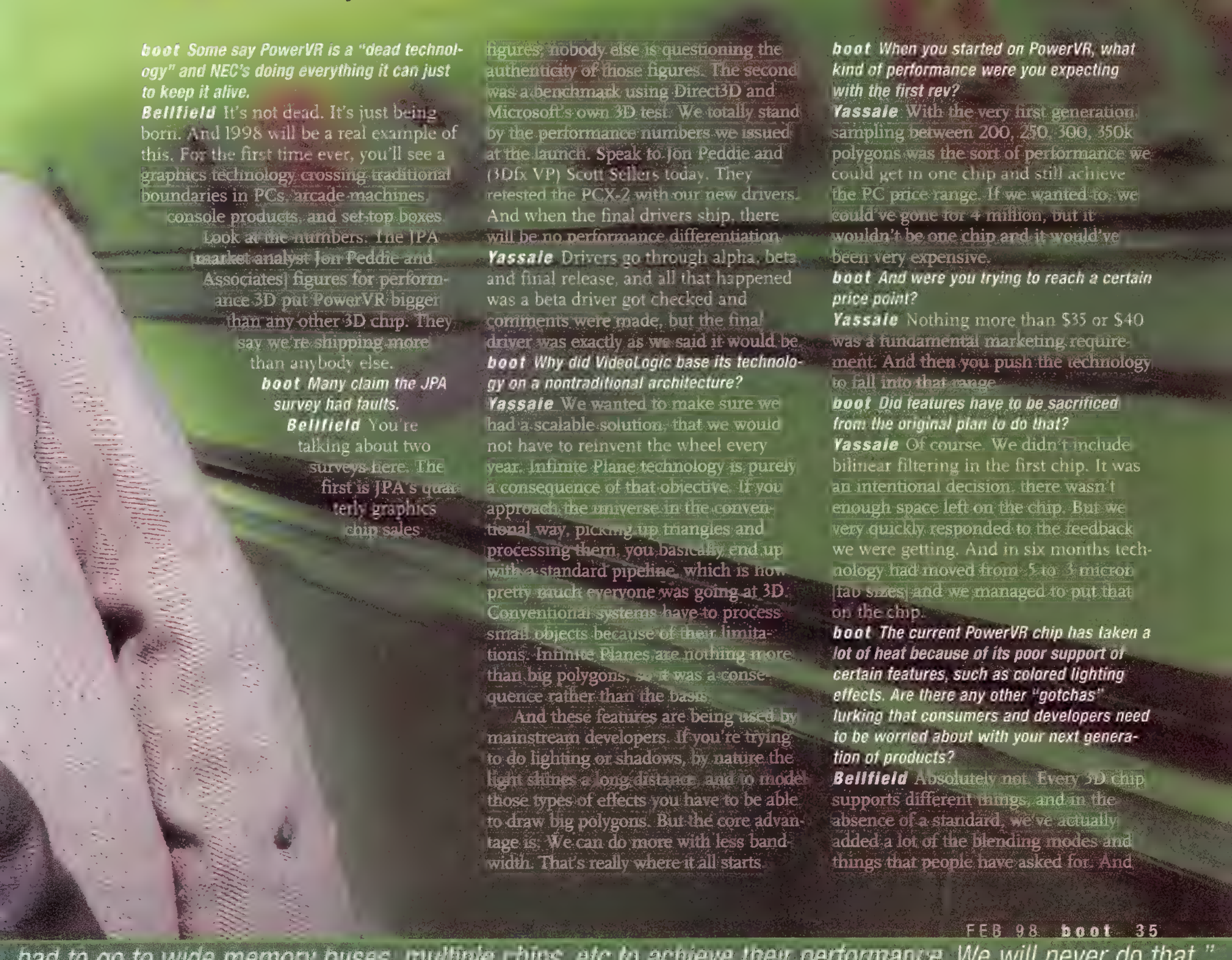
"Look at the chips based on **conventional architectures**, they've already

rection

For PowerVR, 1997 was a vexing year. Software support was critically low, despite NEC's $25 million infusion. And with 3Dfx coming on strong, this alternative 3D architecture with deep pockets appeared good as dead.

But out of the darkness came a light, pointing the way to salvation. The miracle? Matrox's $99 Quake card—the M3D—which breathed new life into the ailing giant.

With a lucrative Sega contract in the bag, a slew of software on deck, and five new chipsets coming down the pipe, VideoLogic's ***Hossein Yassaie*** *and NEC's* ***Charles Bellfield*** *are ready for a 3D resurrection.*



boot ***Some say PowerVR is a "dead technology" and NEC's doing everything it can just to keep it alive.***

Bellfield It's not dead. It's just being born. And 1998 will be a real example of this. For the first time ever, you'll see a graphics technology crossing traditional boundaries in PCs, arcade machines, console products, and set-top boxes. Look at the numbers: The JPA [market analyst Jon Peddie and Associates] figures for performance 3D put PowerVR bigger than any other 3D chip. They say we're shipping more than anybody else.

boot ***Many claim the JPA survey had faults.***

Bellfield You're talking about two surveys here. The first is JPA's quarterly graphics chip sales figures; nobody else is questioning the authenticity of those figures. The second was a benchmark using Direct3D and Microsoft's own 3D test. We totally stand by the performance numbers we issued at the launch. Speak to Jon Peddie and (3Dfx VP) Scott Sellers today. They retested the PCX-2 with our new drivers. And when the final drivers ship, there will be no performance differentiation.

Yassaie Drivers go through alpha, beta, and final release, and all that happened was a beta driver got checked and comments were made, but the final driver was exactly as we said it would be.

boot ***Why did VideoLogic base its technology on a nontraditional architecture?***

Yassaie We wanted to make sure we had a scalable solution, that we would not have to reinvent the wheel every year. Infinite Plane technology is purely a consequence of that objective. If you approach the universe in the conventional way, picking up triangles and processing them, you basically end up with a standard pipeline, which is how pretty much everyone was going at 3D. Conventional systems have to process small objects because of their limitations. Infinite Planes are nothing more than big polygons, so it was a consequence rather than the basis.

And these features are being used by mainstream developers. If you're trying to do lighting or shadows, by nature the light shines a long distance, and to model those types of effects you have to be able to draw big polygons. But the core advantage is: We can do more with less bandwidth. That's really where it all starts.

boot ***When you started on PowerVR, what kind of performance were you expecting with the first rev?***

Yassaie With the very first generation, sampling between 200, 250, 300, 350k polygons was the sort of performance we could get in one chip and still achieve the PC price range. If we wanted to, we could've gone for 4 million, but it wouldn't be one chip and it would've been very expensive.

boot ***And were you trying to reach a certain price point?***

Yassaie Nothing more than $35 or $40 was a fundamental marketing requirement. And then you push the technology to fall into that range.

boot ***Did features have to be sacrificed from the original plan to do that?***

Yassaie Of course. We didn't include bilinear filtering in the first chip. It was an intentional decision, there wasn't enough space left on the chip. But we very quickly responded to the feedback we were getting. And in six months technology had moved from .5 to .3 micron [fab sizes] and we managed to put that on the chip.

boot ***The current PowerVR chip has taken a lot of heat because of its poor support of certain features, such as colored lighting effects. Are there any other "gotchas" lurking that consumers and developers need to be worried about with your next generation of products?***

Bellfield Absolutely not. Every 3D chip supports different things, and in the absence of a standard, we've actually added a lot of the blending modes and things that people have asked for. And

had to go to wide memory buses, multiple chips, etc to achieve their performance. We will never do that."

"NEC just announced a **much bigger** investment than all

Hooked on Quake 2

boot *Quake II is a big title for you guys right?*
Bellfield Yep.
boot *So how would respond to id's Brian Hook, who called the image quality on the PCX2 "very poor" [compared to the Voodoo2] in his .plan file?*
Bellfield You're talking about the same [illegible] Hook who [illegible] PowerVR "totally rocks"?
boot *Yep.*
Bellfield It's a very [illegible] that lighting and te[illegible] [illegible] three to six [illegible]

you'll see those in our future chips.
boot ***Oak Technology is pushing a very similar 3D architecture and they seem to be ahead in several of the key areas. How did they manage to leapfrog you and what advantages do you have over them?***
Bellfield Actually Oak's not the only one pushing tiling-based technology. At Siggraph, there were 10 other graphics chip manufacturers who said they're doing a tile-based accelerator.
Yassaie But, we are definitely the leader in this architecture. We even have techniques we haven't even used at this point.
boot ***PowerVR avoids the need for a Z-buffer by sorting all the polygons on the chip, but how will the architecture scale to handle 100,000 polygons or more per scene?***
Yassaie Bear in mind, we're not sucking all those polygons on-chip. We're doing the top left-hand corner of the screen, and we go through all those polygons and put the pixels on the screen. It doesn't matter whether there's 1 or 50,000 or 100,000 polygons in that area. There's no link between the number of polygons and the timing architecture.
boot ***What are the benefits of the PowerVR's chunking architecture compared to a more traditional pipeline architecture?***
Yassaie Chunking gives us three things. One is scalability. The second is that chunking, or the timing as we call it, allows us to process regions of the screen. This reduces the memory bandwidth, because you're caching chunks of your screen into your chip processing and then continuing on to the next one. The third indirect advantage is better performance. Chunking allows us to do what we call hidden __ or __ on chip. That's what they call "deferred texturing." The advantage is that we're only processing what's visible on the screen. With traditional systems, if you have one object sitting behind another, this first object gets drawn and then the second object gets drawn on the top of it. You touch those two or three times and as the depth complexity goes up, you have to do more of these.

With PowerVR, we only render the front object. And that means less work for the texturing engine. So we'll be able to do more advanced features because we aren't wasting the texture engine doing things it doesn't have to do.

If you look at different chips based on conventional architectures—and I'm not going to mention any specific one—they've already had to go to wide memory buses, multiple chips, etc to achieve their performance. We will never do that. From my point-of-view, rather than putting a chunk of memory on-chip to cope with the fact that I need this enormous bandwidth, I'll add more texture features. I'll add better filtering.
Bellfield But this is an invisible technology. Game developers never see this. It makes zero difference to them. As far as they are concerned, we're a triangle-based technology. They can port directly into 3D and all this proprietary technology is completely invisible.
Yassaie In hindsight, we spent too much time talking about the details of the underlying technology. It's great stuff, but only a handful of people care about how it works. All the developer or the consumer cares about is: Do these polygons hit the screen and do they look nice? I'm happy to talk about Infinite Planes or multiple processing engines, but actually they don't mean anything to the game developer or consumer because they're not visible.
Bellfield The only thing they see is low cost.
boot ***Hearing all this focus on low-cost solutions, one could surmise that NEC and VideoLogic don't think the high-end gaming market is viable anymore. Why not?***
Yassaie I never stated that we are here to deliver lower performance 3D at a low cost. The point is high-performance 3D at the *right* cost.
Bellfield The market wants high-performance 3D, but *not* the high price. The real question is: Can the technologies charging a huge price premium also obtain the greatest demand for the product? And if a 3D technology costs an OEM $100, they then need to sell that at a significantly higher price. But can they sell it? Is there demand for that? Feature-rich SKUs have all but been discontinued.
boot ***Such as NEC's Power Player and Compaq's 7000/8000 line?***
Bellfield Exactly, but he whole vision behind PowerVR is to capture all key markets: the PC, the console, and the arcade, but do it at a relatively low cost, which makes it mainstream.
boot ***The PC industry is well-known for superior technologies being swept aside in favor of superior marketing. Does that concern you?***
Bellfield Absolutely. It's very important to be able to capture the imagination of the market.
Yassaie This is why we put a lot of emphasis on the marketing and development activities, despite the fact that we think we have the best technology around.
Bellfield No single installed base is out there for game developers to sell their titles to. The company who can provide that installed base is the company who will be successful.
Yassaie Technologies and markets come in two flavors: They either have an upper limit or they don't. MPEG and DVD have an upper limit. But with 3D, we never get to a position where we say, "there's nothing

"PowerVR is a technology with **long legs**. This is not like 2D of our competitors. They have the same type of programs in place, but are not willing to publicly admit it."

else we can do here."

We talk about five years of research—big deal! The fun in this industry will actually start in the 2000, when something remotely looks like a movie on your computer screen.

PowerVR is a technology with long legs, and in this business you need to have long legs. This is not like 2D graphics, where once you've done your blits, it's all over. With 3D, there is no limit.

boot ***With the migration of titles to standardized APIs, will your native PowerSGL eventually be phased out?***

Yassaie The reason for maintaining a native API is that every generation will have something new, and often—in fact, 9 out of 10 times—the new stuff isn't supported in standards off the shelf. You have to show it off, make it available to people, and then work with the companies that control those things to make them mainstream. So, PowerSGL Direct will be around and I don't think there's anything wrong with that. It actually forces the standards to go forward quicker than they would otherwise.

boot ***Do you find it frustrating when standards such as Direct3D and OpenGL limit your technology?***

Yassaie It's a reality of life. But I also believe you can work with people such as Microsoft and migrate the standards to support the good features that you have, but it takes some time.

Bellfield We will support *any* API. The most important issue for us is actually getting the game to consumers. It doesn't matter what API they use as far as we're concerned. Direct3D is a very young standard. And look at how long it took Windows to become a graphics standard and you can see how young Direct3D is.

boot ***Which is better: OpenGL or D3D?***

Bellfield I'm a game player, therefore what the game does and looks like is more important to me than the stuff underneath it.

boot ***But if you were a developer and we asked the same question, what would your answer be?***

Yassaie Writing with OpenGL, things are very clear. You can do what you want in a very clear, consistent way. The API has been around for a long, long time and a lot of people have given their input. But something new will be ill-defined. If DirectX is around for a long time, people will get used it. I could say the same about PowerSGL. People who use it say, "Oh it's easy."

boot ***What do you tell someone that bought a PowerVR card thinking there was going to be a lot of software support last year? How do you get that consumer to leave 3Dfx and come back to PowerVR now?***

Bellfield We talk about what titles will ship soon: *Hexen2, Quake 2, Tomb Raider II*—the year of the sequels.

boot ***But a lot of the titles you just mentioned like* Tomb Raider *and* Quake *didn't ship with native PowerVR support.***

Bellfield But *Tomb Raider II* will. And as for *Tomb Raider*, there was no 3D accelerator support when the title initially shipped. All 3D accelerators needed patches.

boot ***But compared to 3Dfx cards, PowerVR doesn't support as many titles.***

Yassaie I'm not sure about that. Any title I want, I can go get.

Bellfield If you look across the board, they're the same. All the titles I just mentioned all have native support. There are differences. You can find things 3Dfx doesn't have and things that we don't have. But on average, I'd say the killer titles are definitely there.

boot ***But still, the problem a lot of people say they have with PowerVR right now is the lack of titles actually out there.***

Bellfield To date we've announced over 100 titles.

boot ***But announcing titles and actually getting them up on store shelves are two different things.***

Yassaie We've actually launched PowerVR Direct, where you can actually go and buy PowerVR titles on the Internet. So it's not a question of where are they. There's quite a lot of titles available now and many coming in the next few weeks. *(editor's note: As we went to press, 25 titles were available at the powervrdirect.com site, and 5 more were listed as "coming soon".)*

AKA

boot ***How important is anti-aliasing?***

Yassaie Everyone today does bilinear texturing, which is a type of anti-aliasing. People use mip-mapping, which is a type of anti-aliasing. And you're going to see even more incarnations of anti-aliasing. But eventually the whole image needs to be anti-aliased, not just edges and textures. And then the picture will look absolutely fantastic.

Bellfield You can go endlessly through all the games we've announced and shown, all big titles. There are more titles on PowerVR than on Nintendo 64 *(editor's note: According to N64.com, there are currently 46 titles shipping for the Nintendo 64, and another 50 coming soon)*. I think this was the issue nine months ago. And that is when we announced the PowerVR ready program for working with game developers to deliver those titles. The whole program was a significant investment: $25 million to assist developers making titles for PowerVR.

boot ***How much did NEC pay for* WipeOut XL*?***

Bellfield We did not pay for *WipeOut XL*. We did take the sub-licensing rights for *WipeOut XL* to provide it to our OEM customers.

boot ***So, how many titles have you paid for?***

Bellfield We haven't paid cash for *any* titles. [3Dfx VP] Mr. Sellers was completely incorrect in his assertion [Lip interview, *boot* 15].

boot ***So what happens when NEC's $25M runs out?***

Bellfield It won't. NEC just announced a much bigger investment than all of our competitors. They have the same type of programs in place, but are not willing to publicly admit it.

In his own interview, Scott Sellers commented that he also has programmers that support game developers, and he also said you had to target programming resources into specifically optimizing his hardware and drivers, even for benchmark programs.

boot ***Is a valid 3D benchmark possible? Or should people care more about visual quality and frame rates versus an abstract score?***

Bellfield The question is: "So Mr. Ziff-Davis, how long do you spend playing 3D WinBench 98 on your PC at home?"

It took 10 years to get an industry accepted benchmark program for CPUs—10 years! We've now had two years with 3D benchmarking, okay? We've got eight more

graphics, where once you've done your blits, it's all over. With 3D, there is no limit."

"Our competitors find benchmarks a **real pain** because they have to spend a lot of time optimizing specifically

years to go until I think the industry may get behind one benchmark program. So let's use actual titles, let's use frame rate, let's use the feature set, and use 'em across a range of titles to take into account all the APIs involved. That is what I recommend and after speaking to our customers, that's what they're doing.

Yassale The problem with benchmarks is that they take a subset of some giant enormous thing and say "This is it."

But having said that, do we take benchmarks seriously from an engineering point-of-view? We spend more time listening to developers and customers, but we do say, "Okay there are some benchmarks here. How do we rate with these things?" But that's where it stops.

***boot* But many manufacturers base their OEM decisions on a single benchmark score. So if your 3D WinBench score isn't the highest, your technology won't be the one the consumer brings home.**

Yassale People like us develop 3D technology and then some guy over there says how you measure it. If that thing matches what you have exactly, great. You get nice numbers if you have more than what it measures, nothing is counted if you have less. Unfortunately, once that benchmark is there, the hardware community will take the things measured into account in their silicon Then they'll all have the same numbers because it measures this and this and this, so let's just put them in the hardware. And I think everyone will do that. They've done it with the 2D and they'll do it again. Then it becomes a minor factor and we go back to the games being the most important thing.

I wish the PC market wasn't like this, but unfortunately it is.

Drivers for Miss Daisy

***boot* PowerVR has been in consumers' hands for more than a year now, yet the Direct3D driver is still mediocre at best.**

Yassale Look at the D3D titles running on PCX-2 today; they're among the best. Will our future product support DirectX better and more directly? The answer is absolutely yes. But we've come a long way in D3D support over the past 12 months.

***boot* So it should get a lot easier for consumers to run your games?**

Yassale Yes. But with any hardware, not all the functions and blending modes and things of *every* API is supported by every piece of hardware. And PowerVR is no different. Our intention is to support 99.99% of the key features that the mainstream APIs have and the developers are asking for.

***boot* Now you've got to start concentrating on optimizing the benchmarks so your technology at least appears to be just as good.**

Bellfield Our competitors find benchmarks a real pain because they have to spend a lot of time optimizing specifically for certain benchmarks. And we do not do that. We are concentrating on the titles.

We believe the actual 3D technology is strong enough to convince our customers. The Matrox M3D is living proof of that. Another is the design win on the Cyrix Media Center where we're the first 3D-only chip to be on the motherboard ever.

***boot* But Cyrix might be classified as a "has been" processor company.**

Yassale You tell that to the Compaq Presario 2200 customers.

***boot* Cyrix's processors fall far below the performance of the K6 and the Pentium II.**

Bellfield The biggest growth in the PC market space today is in the sub-$1000 PC market—that segment has captured almost 20% of the market over the past twelve months. And what is driving that effort? Products such as the Compaq Presario 2200.

***boot* We'll see how that pans out. Back on the high-end, Voodoo II is making a lot of headlines right now for its performance. Did that announcement change anything you were planning for '98?**

Bellfield and Yassale [*together*]: No.

***boot* So what's your answer to Voodoo II?**

Yassale We *could* gang multiple PowerVR chips and do two-board solutions but our focus is on the mainstream. The majority of people are not interested in two or three cards in one system. We ask ourselves, "Does it make business sense to go out and promote that?" So far it hasn't.

Bellfield Our objective is to have single chips with sufficient performance that satisfies the majority. We will not come out with products which have a higher chip count or a higher cost.

***boot* Can we expect to see 100fps in a PowerVR product?**

Bellfield Dramatically higher performance in next generation of products—absolutely.

***boot* But you're not willing to commit to a certain frame rate?**

Bellfield What's the point of sitting here and committing to a number? You've seen all of the mistrust behind coming out with our own frame rate numbers—it's to no one's benefit.

Yassale My objective is to make sure we can run all the games we expect to come out at 60fps and above.

***boot* 60fps then?**

Yassale I said "and above." Because that's where I think one needs to be.

***boot* Can frame rates get too high?**

Yassale Yes. I don't subscribe to this business "We can do 200fps..." It doesn't actually mean anything. 24fps is sufficient for a movie, but they're not interactive. The arcade is where there's a lot of interactive experience, and 60fps is about right. I'd rather make sure every game goes 60fps and have more features.

Bellfield Let's be realistic. Give me an example where you're actually able to see 150fps... you can't.

Yassale Would you pay more for your favorite game running at 150fps, rather than 60?

Bellfield I wouldn't because there's no way to see the difference.

Yassale If I have to pay more money for that, that's a waste of money. I'd rather buy another game with the difference.

So we've taken a balanced view. A lot of the games, particularly with high complexity, consume quite a lot of the CPU these days. But Intel is introducing faster CPUs, which will help. And so a lot of the times the number of frames you get isn't really limited by the hardware or the API. It's limited by how much time is spent in the dynamics of the game. Developers will tell you the dynamics of the game—particularly as the games are becoming more intelligent—are consuming a lot of time, so

"Voodoo2 is only one product in the marketplace, but we're saying we'll **surpass all** of them, for certain benchmarks. And we do not do that. We are concentrating on the titles."

faster CPUs are more important than pure frame rates.

***boot* Do you see 3D moving out of the gaming space?**

Bellfield Eventually, absolutely. Today, games are pushing the technical boundaries of PCs. Going forward, we will totally support any application that wishes to use a 3D interface. If this is a business app, then we will support it.

Yassaie Visualization has become more mainstream rather than just the esoteric CAD/CAM market. I think the real explosion probably will happen when the network is fast enough. At the moment, you can't actually suck databases into your machine.

Bellfield Movies such as *Disclosure* give a virtual look into the future of 3D graphic interfaces really making life much easier for the user.

Yassaie As $1000 PCs and consoles become connected to Internet and have standard OSs running on them, user interfaces will become much more 3D.

Bellfield And PowerVR is the only technology today that can do that.

***boot* What impact will AGP have on the 3D experience?**

Yassaie AGP is an extension on what we've said all along: "Let's get rid of memory because we don't need the benefit." And AGP allows us to do that very nicely.

As AGP becomes mainstream, you'll see PowerVR scoring better compared to the conventional technologies.

***boot* So when can we expect to see some PowerVR cards for the AGP bus?**

Bellfield We are introducing five new products during this year. One is a complete 2D/3D feature set product which has full AGP support.

***boot* So is that what Highlander is?**

Yassaie: Highlander's a code name for any 2D/3D integrated solution started the same time as PowerVR.

***boot* Then what specifically are the five products?**

Bellfield At least two of these products are on the PC platform. On the PC side we have a family of single-chip products—these are five different chips. Our single-chip solutions are the same or lower priced than what we have today, but with much higher performance and with a much richer feature set.

***boot* What kind of features are we talking about here?**

Bellfield You can expect full DirectX and OpenGL blending modes, full CPU load balancing, full-floating point setup on chip, and a dramatic increase in fill-rate. And certainly, advanced texture filtering modes, as well as texture compression. We'll also do 2X AGP with sidebands. Our competitors' 2D/3D products in 1998 will not be 2X AGP.

***boot* From a game perspective, how much of an increase can we expect?**

Bellfield Again, based on our single chip solutions, we'll be looking at performance which exceeds any of our competitors announced products in 1998.

***boot* You keep saying "single-chip solutions." You don't consider 3Dfx's Voodoo 2 a competitor?**

Bellfield No, we certainly do. But we're talking about our single-chip solutions competing in the same marketplace. And our new chips will exceed the performance of our competitors' products, but we will be a one-chip solution with a much-lower price.

***boot* You're saying the new PowerVR will have better performance than the Voodoo 2 but it'll cost around a $100?**

Bellfield Yes. Voodoo2 is only one product in the marketplace, but we're saying we'll surpass all of them, at the same or lower price points than we currently have today. We're also talking about combined 2D/3D products, which will include MPEG 2 decode, DVD-assist, and video-IN and -OUT as well.

***boot* Could the second product be a motherboard solution, as opposed to an add-in card?**

Bellfield Yeah, or it could be a very high-end arcade Model 3-type performance for the PC. ▯

They Might Be Giants

***boot* 3D acceleration has turned the graphics world upside down, toppling giants like S3, Cirrus, and Trident. What companies do you predict will be the leaders in the new world order?**

Bellfield This market is big enough for all of us, so to speak. Certainly we're not and none of our competitors would be looking to take 100% of the market—that would be impossible. There are many people here today and there will be many people here tomorrow. Six months ago there were 47 companies in the chip business, but today there are probably around 36 or 37. Now that's still one hell of a lot of companies. Yes, there will be a shakeout in '98 and there will be key survivors.

***boot* Does Intel's Auburn technology concern you?**

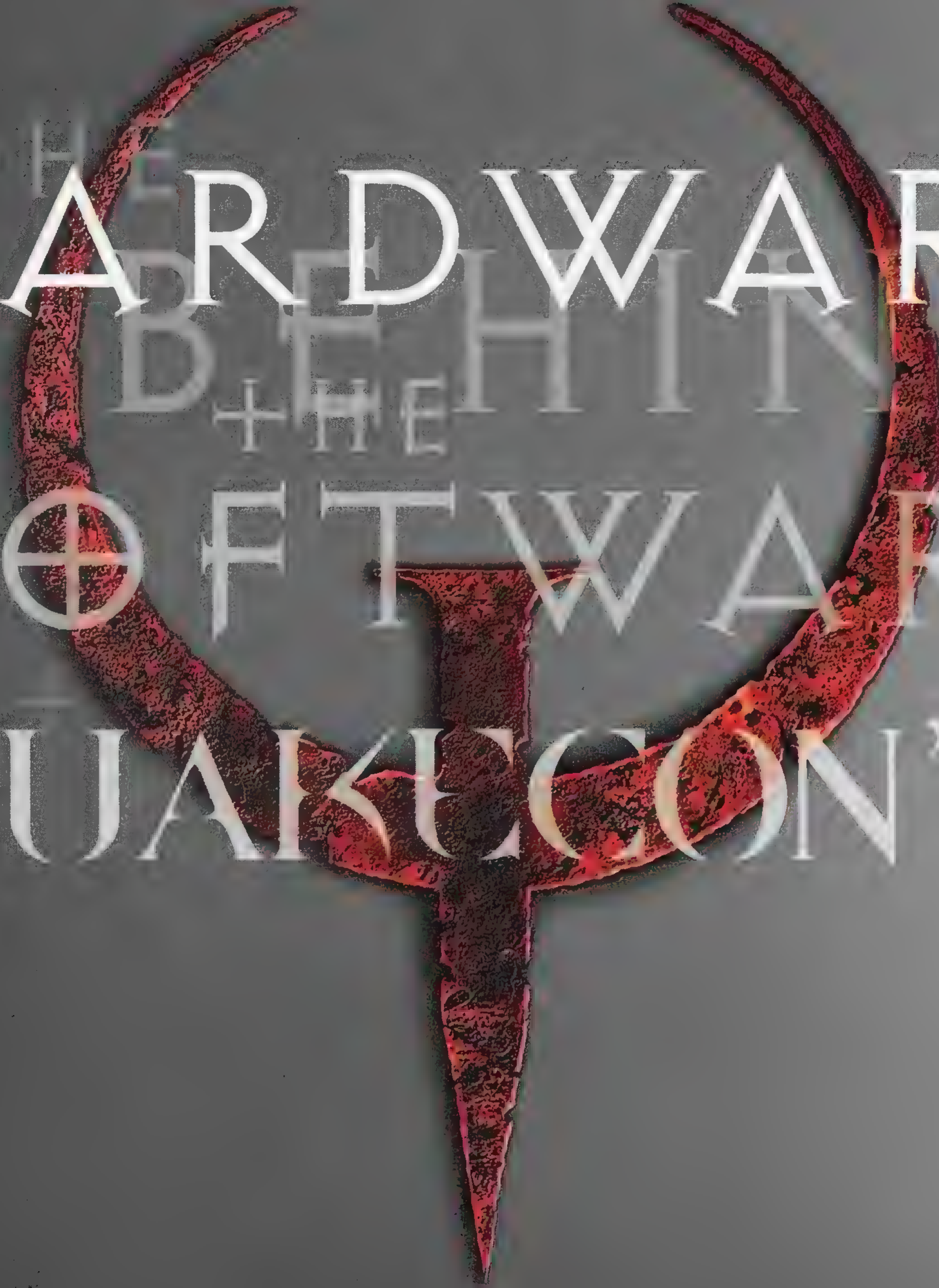
Bellfield No. This market is big enough for many different companies. Intel has already been quoted saying they want 20% of this market. That leaves the rest for everybody else. They will be a player, but one of *many* players.

***boot:* What do you think of the technology?**

Yassaie We've seen it in action and it looks good, but it's based on conventional Z-buffer systems.

Bellfield You're talking about one chip designed specifically for one platform. That will not give the market penetration you need.

at the same or **lower price** points than we currently have today."



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HARDWARE
BEHIND
THE
SOFTWARE
AT
QUAKECON '97

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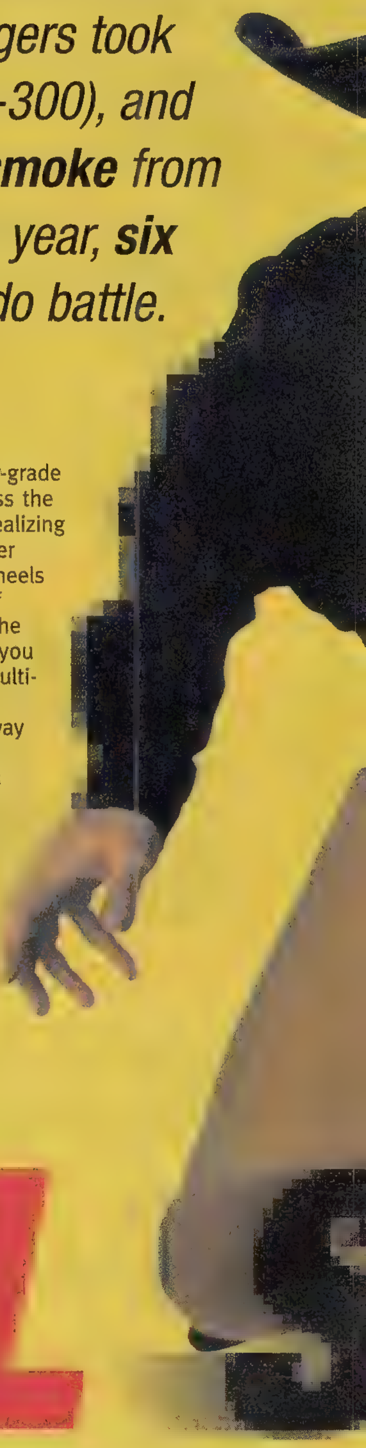
Nearly a year ago, boot ***wrangled up*** *the best consumer* ***digital cameras*** *the world had to offer and put 'em all* ***toe-to-toe*** *in our first* ***shoot-out****. Some slingers took it between the eyes (Casio QV-300), and some walked away* ***blowing smoke*** *from the barrel (Sony DCS-F1). This year,* ***six more contenders*** *step up to do battle.* ***Who will be left standin'?***



With their second legitimate generation, consumer-grade digital cameras have come of age. Luddites might miss the shoebox full of fading prints, but everyone else is realizing the awesome advantages of going filmless. Whether you're e-mailing a snap of your spankin' new wheels to a friend on the other coast or posting pix of your latest vacation adventure from the road, the digital camera is the indispensable tool. And if you have a creative streak, these killer cams are the ultimate source for editable images.

But with prices a fair step beyond the cardboard throwaway that passes for a camera today, the savvy shutterbug must shop smart. Many of the salespeople hawking these goodies aren't up to speed and haven't tried the twenty-some cameras out. Whenever possible, try the camera yourself before committing your cash. Shoot the sort of images you anticipate using the camera for. Study the downloaded files carefully. Zoom in and examine the JPEG compression for artifacting. With these prices, you don't want to invest in the wrong camera.

Let's look at some of the key factors you should consider before taking your best shot.

DIGITAL

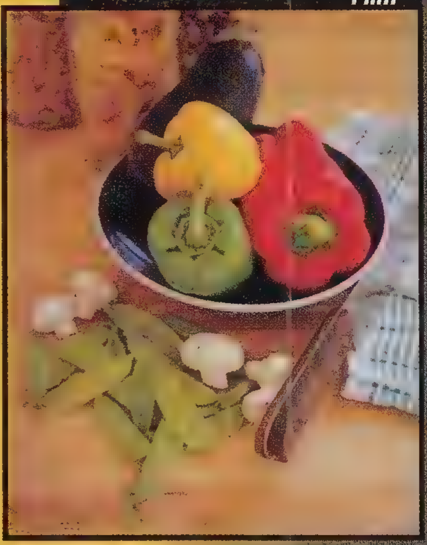
SHO TOUT

COLORQUALITY

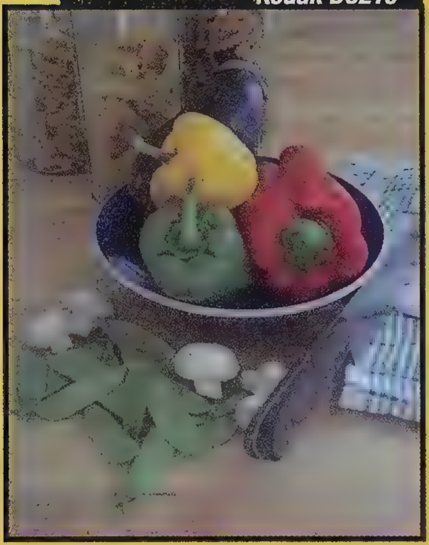
Most people want rich colors in their photos, and different cameras deliver in different doses. Like it's photographic film, Fuji's camera delivers the brightest colors of this shoot-out. The only shortcoming is that these colors aren't always accurate, occasionally exaggerated for effect. The Kodak and Olympus cameras yield richer, more realistic tones. Many of the images in the shoot-out appear with the blue-cast typical of open shade, but this is easily corrected in any competent image software. For example, in *Photoshop*, simply launch Levels and bring the minimum and maximum values for each channel to where the values begin. This generally produces the best neutral results and preserves all the image's data.

Luckily, none of the cameras in this shoot-out displays the sort of unacceptable random color shift found in many of the lower-end, first-gen digital cameras, and shadow mottling was visible only in the Umax images.

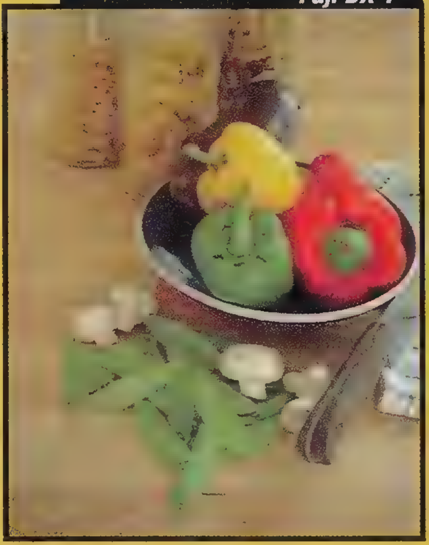
Film



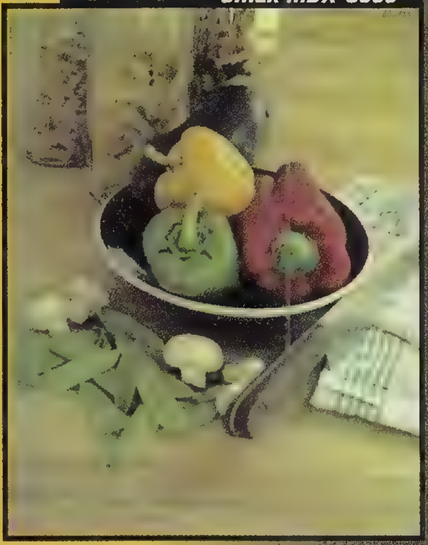
Kodak DC210



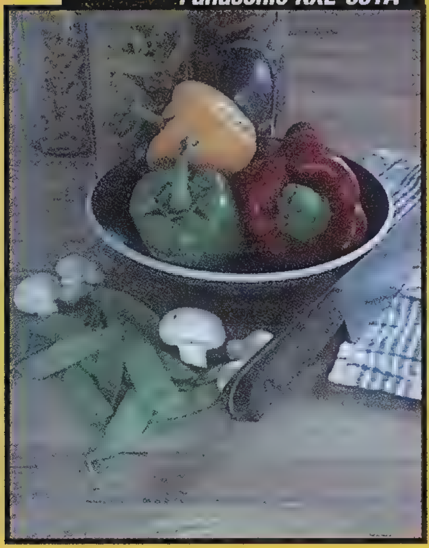
Fuji DX-7



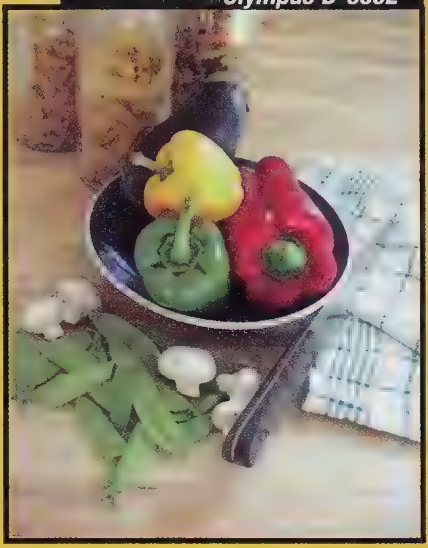
Umax MDX-8000



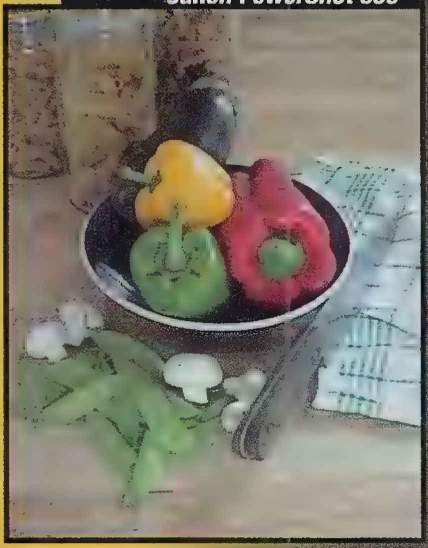
Panasonic KXL-601A



Olympus D-600L



Canon PowerShot 350



RESOLUTION

Nothing has a bigger impact on image quality and versatility than resolution. The greater the resolution, the more raw material you'll have to work with if you decide to blow up the image, reproduce it in print, or crop in on crucial details. Today's breed of cameras generally bottoms out at 640x480, or full-screen on most notebook PCs. Anything less and you're almost guaranteed to be disappointed. This year's seen a slew of cameras challenge the high-end of the resolution scale, with 1280x1024 models from Agfa and Olympus.

But a higher resolution doesn't guarantee a better image. Case in point: The Umax MDX-8000 in this year's shoot-out touts 1000x800 pixels of resolution, but its image quality is still substandard.

The unspoken factor in image quality lies in compression. Nearly all digital cameras write images in JPEG format, and all camera makers make a tradeoff between the number of images the camera can hold in memory and how aggressive the JPEG compression is applied. JPEG is a lossy algorithm, which means cranking up the compression will result in artifacting. All images will have some artifacts, especially in trouble spots such as close parallel stripes, specular highlights, and mottled shadow details, but these are magnified when compression is applied too heavily.

LCD SCREEN

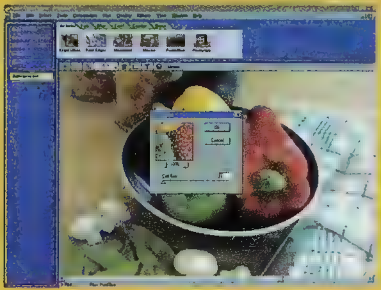
One of the greatest benefits of digital cameras is the ability to preview the picture in the field with the built-in LCD screen on most cameras. The advantage of this fea-

Adobe PhotoDeluxe 2.0

As the most common software bundled with digital cameras, *PhotoDeluxe* had better be good. But the crowded screens, imperfect wizards, big idiot buttons, and limited options, are still present in version 2.0.

The crowded screen interface virtually eliminates the program's effectiveness on laptops' small LCDs. Nearly a quarter of the screen is consumed by tabbed palettes and buttons that can't

continued on next page



Kodak DC210

With all the requisite features (LCD p/review screen, removable storage media, built-in flash, macro focus, and TV out), the DC210 is a very capable camera. But it doesn't stop there. A 2x zoom and mega-beefy 1152x864 resolution take this baby to the next realm.

Packed into a rock-sturdy two-tone silver body, the DC210 is the heaviest camera in this shoot-out (save the mondo D-600L) at nearly one pound. In the course of our testing, this camera took its fair share of tumbles and always came up shooting.

The camera's controls are exceptionally intuitive, from the thumb-toggled zoom to the clearly labeled mode dial on the back. In addition to the great ¼-inch color LCD interface used to review images (including a zoom feature), the camera sports an additional black-and-white LCD on top to indicate pictures remaining, resolution, and the status of the memory card, flash, self timer, and battery.

The biggest critique of the DC-210 is rooted in its art-deco design, which is too smooth for its own good, creating ergonomic havoc. First off, it's a good thing the camera is so damn sturdy because its slick curves had it regularly slipping out of our hands. A rubberized grip with some texture would've been nice. Also, the power button can easily be confused with the shutter button—which sits a quarter-inch away.

Still, image quality's the thing, and Kodak's DC210 doesn't disappoint. Pictures taken with this camera are sharp and detailed. Color casts are minor and easily corrected, even with the anemic *PhotoDeluxe* software provided with the camera (in a daring move, Adobe's *PageMill* also comes with the DC210.)

All around, there's an awful lot to like about this snazzy camera.

Price $899
Company Kodak
Phone 800.235.6325
URL www.kodak.com

boot verdict
9

Fuji DX-7

Fuji's latest foray into the digital camera realm is a solid offering. The sturdy DX-7 sports solid construction and good ergonomics, along with bright images.

At first glance, you might mistake the DX-7 for a top-flight point-and-shoot film camera. That is, until you flip it around and see the 1.8-inch LCD on the back. The screen augments the optical rangefinder for framing shots and can be disabled when not in use to conserve battery life. Pertinent settings data is superimposed on the LCD screen, which smoothly displays the scene without stutter.

Firing up the camera produces a melodic series of tones that make the camera inappropriate for undercover spy work. In fact, many of the camera's operations are accompanied by these pleasing tones.

The images produced by the Fuji camera are reminiscent of the images from the company's film: exceptionally colorful. The DX-7 handled even the most lowlight situations with aplomb, producing glowing images, vibrant with color. Sometimes these colors did not reflect the real colors in a given scene and frequently detail was sacrificed, but the pictures were pleasing to the eye nonetheless.

The DX-7's biggest problem is with the paltry TWAIN drivers that accompany the camera. This software just doesn't compete with the software that comes with most digital cameras. Fortunately, once you figure out how to run the software, image downloads were the fastest in this shoot-out, as were write times for images (an amazing four seconds!).

Overall, the DX-7 is a great camera for the casual shooter, but lacks the detail and accuracy many will demand.

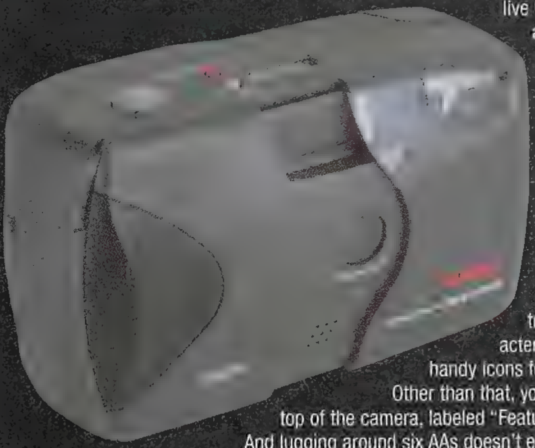
Price $499
Company Fuji
Phone 800.755.3854
URL www.fujifilm.com

boot verdict
7

Umax MDX-8000

This camera sounds good on paper: high-res 1000x800 images, unheard of 30-bit color depth, even a built-in mike for annotating images with up to five seconds of sound. But it all goes wrong in the execution.

For starters, Umax left off the LCD screen. No memory management for you! You take a picture, you live with it (unless you decide to delete it immediately, but without a preview screen how could you know if you missed the shot?). And, obviously, you can't frame the shot with the MIA LCD screen. This means you must use the rangefinder. Now it gets ugly. The molded plastic that houses the front of the rangefinder (and the built-in flash) distorts the image hideously, making effective framing of the scene impossible.



In fact, your only interface with the goings-on in the camera is a meager black-and-white LED on top of the camera. This paltry screen is limited to six calculator-style characters that spew cryptic messages in lieu of the handy icons found on most other digital cameras.

Other than that, your controls are limited to two odd buttons on top of the camera, labeled "Feature" and "Change/Delete."

And lugging around six AAs doesn't engender any warm feelings either.

Matters don't improve once the rubber hits the road. The MDX-8000's images are as bad as the camera's design. Raw images are contrasty, and colors are washed out in everything but open sunlight. Indoor shooting produces severe mottling of shadow areas. And the fixed-focus mechanism keeps detail to a dull fuzz.

The only good news about this car crash of a camera is that Umax plans to build its next camera in-house, instead of contracting out like they did with the MDX-8000.

Price $499
Company Umax
Phone 800.562.0311
URL www.umax.com

boot verdict 2

Panasonic KXL-601A

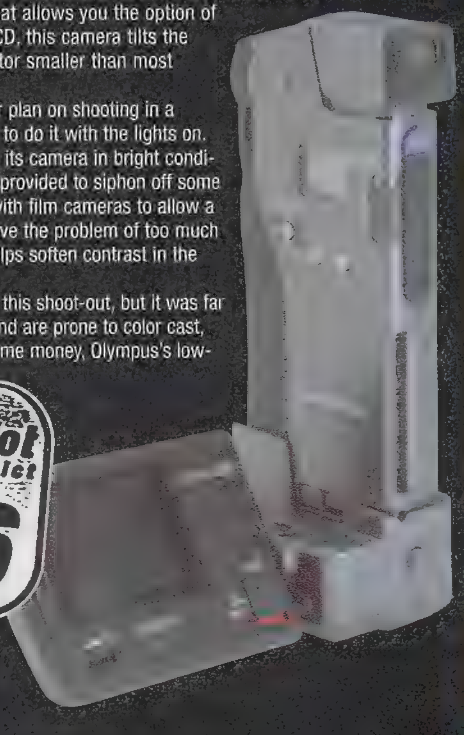
The Panasonic KXL-601A (that's a catchy name, huh?) is such a design departure from any prior camera—digital or otherwise—that it seems to have been conceived with a specific purpose in mind. Somewhere, someone was thinking, "What I really need is a camera that operates like a periscope."

In fact, if the vertical design (for vertical markets?) isn't enough periscope action for you, push a button and pop up the viewfinder for a little extra elevation.

The viewfinder on the KXL-601A is optional because the LCD framing screen is a removable option. This is an innovative idea that allows you the option of traveling light. And travel light it does. Sans LCD, this camera tilts the scales at a mere 6 ounces and has a form factor smaller than most checkbooks.

Still, there are sacrifices. Like a flash. Better plan on shooting in a well-lighted place, because the KXL-601A likes to do it with the lights on. In fact, Panasonic's so confident you'll be using its camera in bright conditions that a unique ND (neutral density) filter is provided to siphon off some of those LUXs. These filters are typically used with film cameras to allow a more shallow depth of field, but CCDs rarely have the problem of too much light. Instead, on the KXL-601A, the ND filter helps soften contrast in the images.

Image quality in general wasn't the worst in this shoot-out, but it was far from the best. Pictures have acceptable detail and are prone to color cast, but all within correctable ranges. Still, for the same money, Olympus's low-end offerings sport much better image quality and make a much better choice—unless you happen to be a sub commander.



Price $599
Company Panasonic
Phone 800.222.4213
URL www.panasonic.com

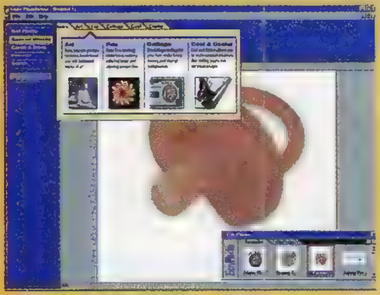
boot verdict 6

ture cannot be understated. Not only does it allow you to ensure you have captured what you were shooting for—no blinking portraits, no flashless night shots, no mysterious pink thumb blocking the view—it also allows you to scan your pictures and selectively delete images in order to manage your limited image storage.

Some cameras use the LCD screen to frame the scene when shooting. This is a good thing because it lets you hold the camera away from your face, making your subjects less camera-shy and allowing you to see more of what's going on around you, so you won't miss shots. Unfortunately, if this is the only means of framing the shot, you'll have serious trouble shooting in direct sunlight, especially when the sun is behind the shooter.

The best of all possible solutions mixes the LCD option with a traditional rangefinder, which guarantees the shot in any conditions.

The LCD on most cameras does double duty by serving as the camera's primary interface, allowing you to set the various preferences and check the camera's status. Particularly noteworthy in this roundup is the icon-driven interface on the Kodak



***Photodeluxe** continued from page 45*

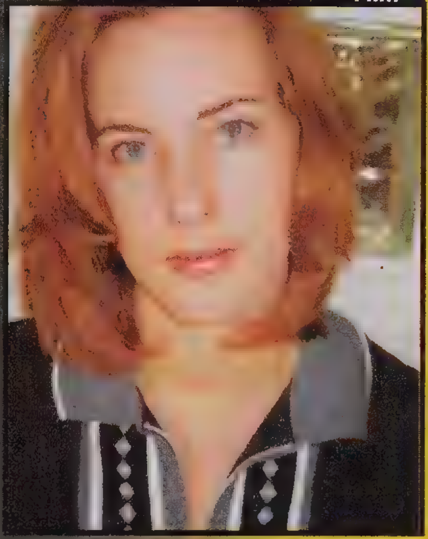
be hidden like other apps' floating palettes. Much of the interface's wasted area is blank, so you can't see even a complete 640x480 image on most screens.

The good news is the tools are much expanded and improved, and the automated processes are a decent substitute for a full-fledged image-editing app, unless you want to get really creative. Is this an acceptable TWAIN client for downloading raw images? Yes. But Ulead's *PhotoImpact* is a better alternative, dollar-for-dollar.

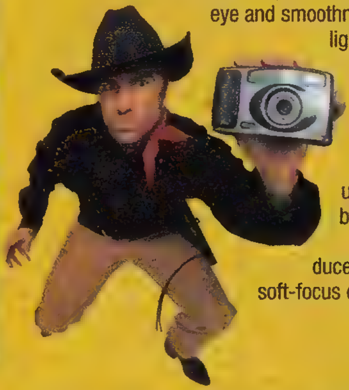
Price $49
Company Adobe
Phone 800.833.6687
URL www.adobe.com

boot verdict 6

Film



FLESH TONES

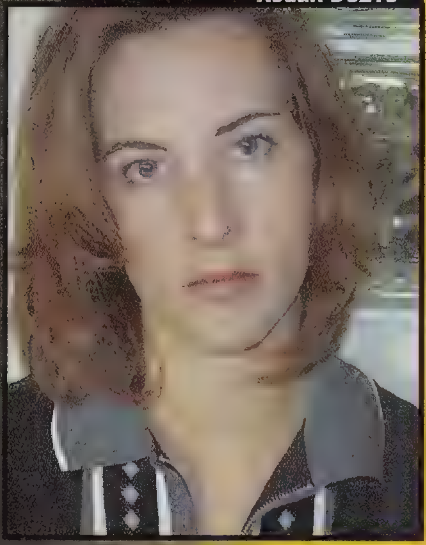


The most common subject matter in photography is people, so the most important test of a digital camera is the portrait. You should see demanding detail such as the catchlight of the eye and smoothness of skin tones. In this test, we shot in flattering indirect sunlight bounced off a fill card.

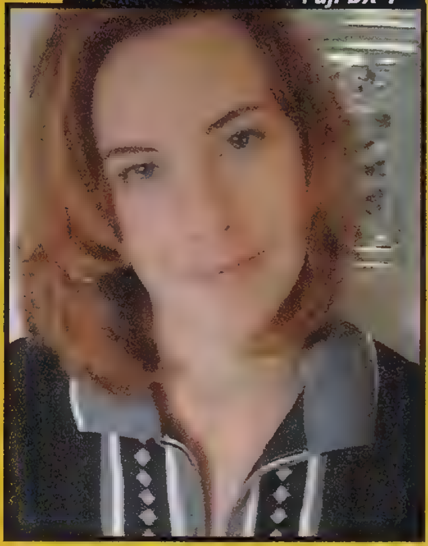
Obviously, the Olympus D-600L's smooth natural skin tones and sharp detail set the standard by which all others must be judged. Finishing in the money is the Kodak camera, which requires only slight color correction for blue-cast. The rest of the cameras struggled mightily with the cast issue, which is particularly brutal on the contrasting hues of skin tones and brings out blemishes with a vengeance.

On the opposite end of the spectrum, the Fuji camera produced exceptionally pleasing warm skin tones. And the camera's soft-focus effects are straight out of Bob Guccione's book.

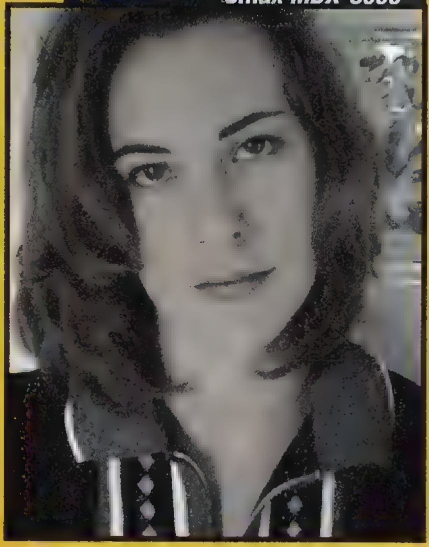
Kodak DC210



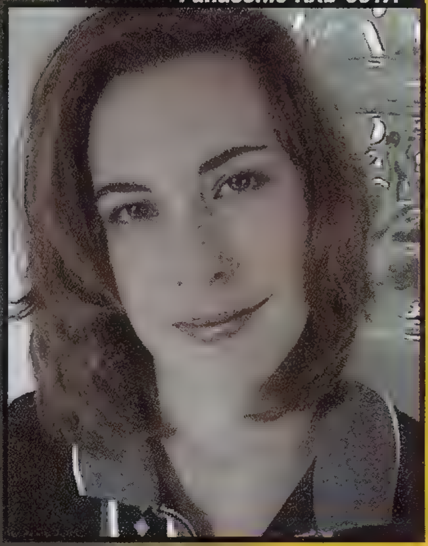
Fuji DX-7



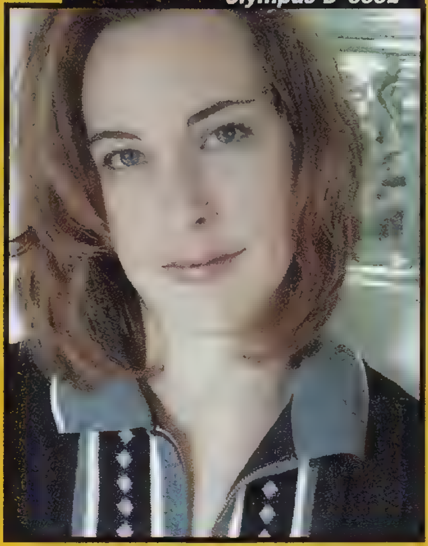
Umax MDX-8000



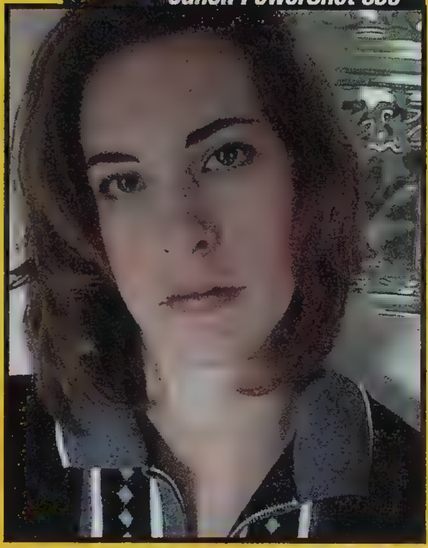
Panasonic KXL-601A



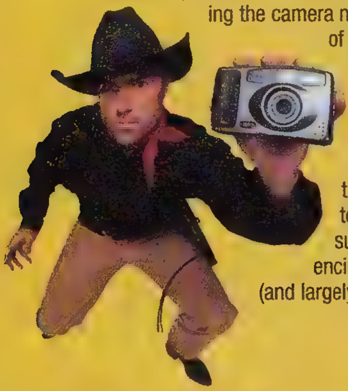
Olympus D-600L



Canon PowerShot 350



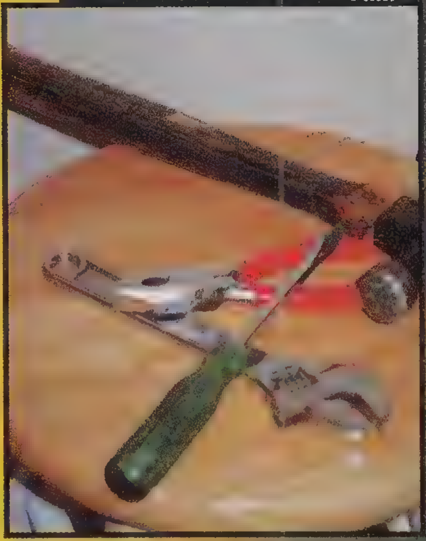
LOWLIGHT



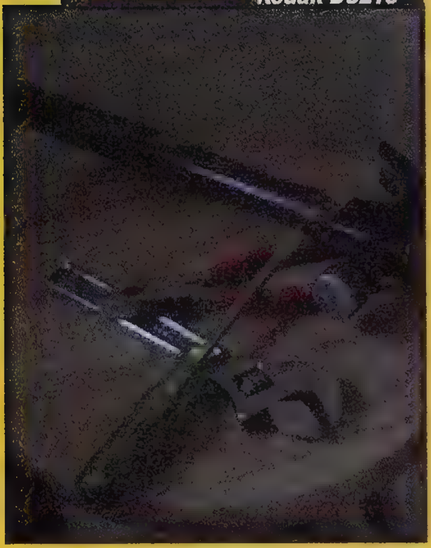
This test is a real catch-22 for digital cameras. Their CCDs stop registering color when light levels drop below a certain point, but slowing the exposure to compensate makes handholding the camera nigh impossible. Most cameras in this shoot-out erred on the side of preserving color and put the burden in the shooter's steady hands, which is good. Unfortunately, many of the auto-focus mechanisms, such as the Olympus, struggled to get a lock in the lowlight.

This was a real ball-buster of a test. Even sturdy contenders such as the Kodak were reduced to tears (although, to its credit, the camera did maintain focus). The Umax utterly died in this test. Canon's camera fought to expose the image properly, but suffered all-too-low shutter speeds as a result. Although experiencing the same shakes, the Fuji surprised us with its über-bright (and largely accurate) colors.

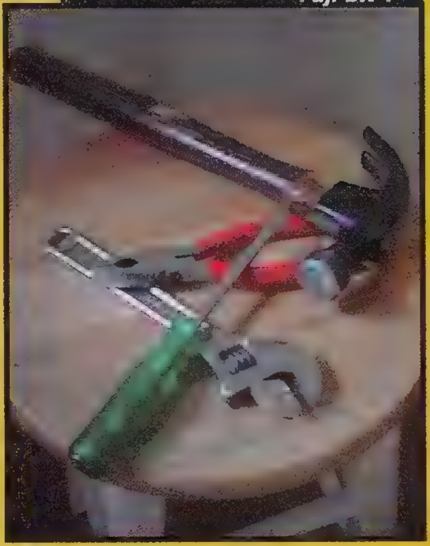
Film



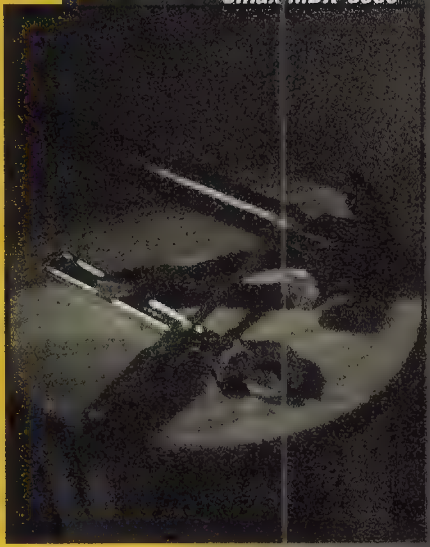
Kodak DC210



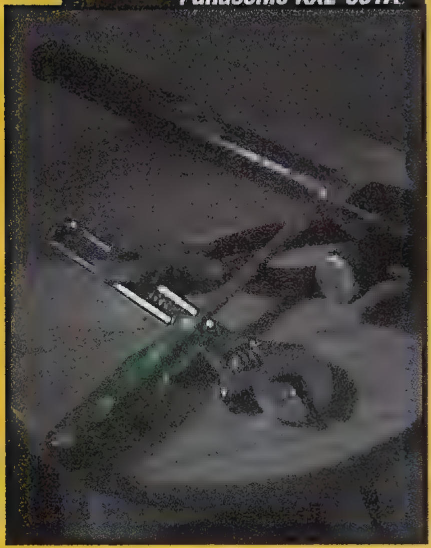
Fuji DX-7



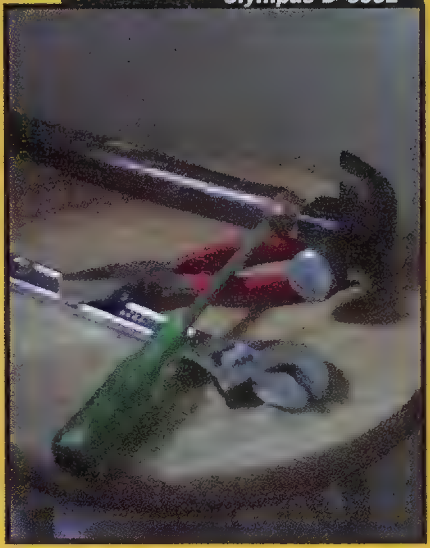
Umax MDX-8000



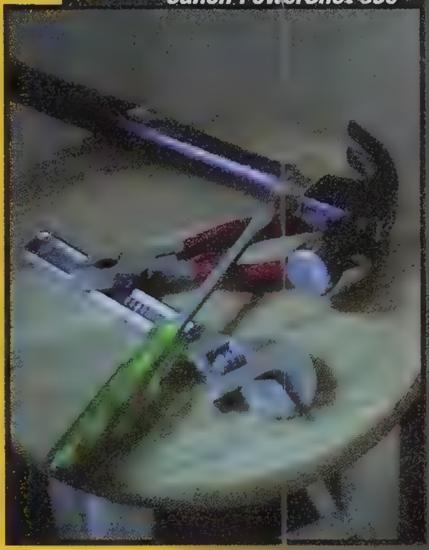
Panasonic KXL-601A



Olympus D-600L



Canon PowerShot 350



▶ DC210, which is reminiscent of a good PDA. In fact, it'll be interesting to see some PDA features built into the next generation of digital cameras.

REMOVABLE MEDIA

In the olden days of last year, digital cameras were judged by how much memory was built into them. Too little and you could be left high and dry after only a few shots. For example, Kodak's tiny DC210 filled with a mere seven high-res shots, and because the camera comes without an LCD screen or selective delete feature, those seven images were a wrap on the day's shooting. A few cameras look forward and provide image storage that can be refreshed in the field, such as the 170MB PC card hard drive that can be used with Canon's PowerShot 600.

In this year's shoot-out, removable storage is a veritable must. And the dramatic strides in media make this feature even more appealing. The PowerShot 600's expensive PC card hard drive has been replaced with technologies such as CompactFlash and SmartMedia. The latter is a one-inch square that's little thicker than the ten pages this article runs. Storage capacities run from 2MB to 8MB, and even larger sizes are coming. Once full, this "digital film" can be pulled from the camera and a fresh card can be inserted. This gives the digital photographer the freedom of unlimited shooting in the field, when a PC is not available for downloading.

When it does come time to download, these new media provide an alternative to traditional cable-driven downloads. Both these forms of digital film can be plugged into an included PC card adapter and plugged directly into a PC card slot. Once there, images can be dragged and dropped onto the desktop. If your desktop doesn't have PC card capabilities, SmartMedia promises an adapter that'll allow a standard floppy drive to read the card.

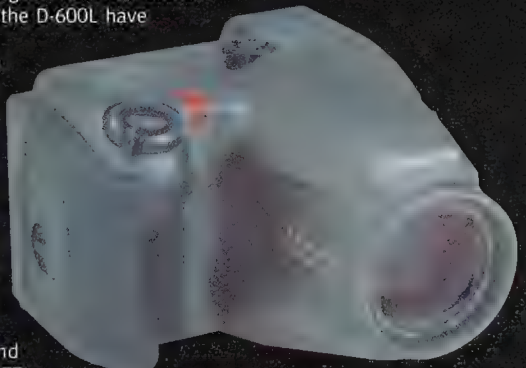
ZOOM

More and more, digital cameras offer the luxury of a zoom lens. Sure you could just take a few steps forward or back to frame the shot, but when that's not possible—such as in a tight room or viewing distant animals at the zoo—this feature is golden. Of this year's contenders, Olympus and Kodak offer zooms, and many even offer the understated benefit of a wide-angle lens. This is a real boon when you're trying to capture the big picture and when shooting in lowlight. Wide-angle lenses capture more light and are less prone to camera shake with slow shutter speeds. With some of the more aggressive telephotos in this year's gathering, this can be a problem. Many of the cameras allow you to zoom in as much as 3x, and with the slow speeds

Olympus D-600L

boot KICK ASS! PRODUCT

This is the Dodge Viper of digital cameras—we're talking Tyra Banks sexy here—from its sleek SLR-style body to the burly 1.4 Mega Pixels under the hood.



The 1280x1024 resolution gives near-film-caliber images. Pictures taken with the D-600L have immaculate detail, amazing color accuracy, and shadow detail richer than Belgian chocolate.

Beyond the sheer muscle, details abound. Your images are channeled to the CCD through a seven-element aspherical lens that puts all other digital camera lenses to shame. Toss in a 3x zoom that's the equivalent of a 36mm to 110mm zoom lens on a 50mm SLR, and you have a no-excuses optical system worthy of the Olympus name.

But similarities to its SLR kin don't end there. The D-600L also features the first TTL optical viewfinder, complete with center-weighted, contrast-detection autofocus. Focus can be locked with a half-press of the shutter button, as can the killer spot-metering mode. The viewfinder even contains dioptic correction. Sweet.

The built-in flash pops up on a stilt 2.5-inches above the lens's axis to reduce red eye, with red-eye reduction mode also available. Other flash modes include auto lowlight and backlight flash, plus a fill flash.

The only caveats for this camera are the top-dollar price tag and the scads of batteries you'll burn through.

Basically, everything about the D-600L is top-rate, from the polished TWAIN drivers to the svelte removable SmartMedia. If you want the best, this is your camera.

Price $1,200
Company Olympus
Phone 800.622.6372
URL www.olympusamerica.com/digital/dhome.html

boot verdict 10

Canon PowerShot 350

Canon's a fixture in the photography world, and its PowerShot 600 was the digital camera equivalent of a muscle car, so its new camera must be better than, say, Konica's Q-EZ Mini, right? No.

Actually, the PowerShot 350 and Konica's first digital camera are the same (save the chrome on the Canon's shutter button). Still, this camera has a lot going for it. The tidy box is hardy and pocketable. And despite its boxy design, a considerately placed thumb divot on the back and ridge on the front make holding the camera a secure experience. An additional touch is the hinge on the camera's 1.8-inch LCD screen that allows it to swivel out up to 40-degrees for easier viewing when framing shots away from the eye.

And you'll do all your shot framing with the LCD, since a rangefinder isn't available. The LCD'S brightness dial helps, but scenes can get bogged down with contrast at max brightness. Another drawback is the LCD screen's lagging screen draw. And the LCD viewfinder on our unit did not accurately reflect the captured image. All this makes framing your shots even more difficult.

Another annoyance with the PowerShot 350 is a constant, high-pitched whine. After an hour of shooting with the PowerShot 350, we heard Satan telling us to do bad things.

Nonetheless, images created with the PowerShot 350 were solid, with plenty of detail and only minor color-cast issues. Zooming in reveals ample stair stepping in the anti-aliasing algorithm, but it's barely noticeable at 100%.

In its price range, the Canon produced some of the best pictures we saw.

Price $499
Company Canon
Phone 800.848.4123
URL www.powershot.com

boot verdict 8

HEAD 2 HEAD

	Canon PowerShot 350	Fuji DX-7	Kodak DC210	Umax MDX-8000	Olympus D-600L	Panasonic KXL-601A
Price	$499	$499	$899	$499	$1,200	$599
Max Res	640x480	640x480	1152x864	1000x800	1280x1024	640x480
Color Depth	24-bit	24-bit	24-bit	30-bit	24-bit	24-bit
Memory	2MB	2MB	4MB	2.5MB +2MB	4MB	2MB
Removable Media	Compact Flash	SmartMedia	Compact Flash	PC Card	SmartMedia	Compact Flash
Images Stored	11 images	22 images	13 images	89 images	11 images	24 images
Other Settings	Normal (23) Economy (47)	Normal (30)	Better (16) Good (25)	Standard (133)HQ	Superhigh (4) Standard (49)	Low-Res (90)
LCD Display	1.8-inch	1.8-inch	1.8-inch	None	1.8-inches	1.8-inches
Flash	Yes	Yes	Yes	Yes	Yes	Optional
Focus	Fixed	Auto-focus	Auto-focus	Fixed	TTL Auto-focus	Auto-focus
Macro	Yes	Yes	Yes	No	Yes	Yes
Shutter Control	1/4-1/1000	1/4-1/5000	1/2-1/362	1-1/2000	1/4-1/10000	1/15-1/4000
Max Aperture	f2.8	f3.1	f4.0	f4.0	f2.8	f2.8
Zoom	3x	None	2x	None	3x	None
Video OUT	Yes	Yes	Yes	No	No	Yes
Software	TWAIN PhotoImpact PhotoDeluxe	TWAIN PhotoDeluxe PageMill	TWAIN	PhotoDeluxe	TWAIN PhotoDeluxe	TWAIN
Size (inches)	3.1x3.6x1.8	1.75x5x2.75	5.25x3x1.75	5.25x3x2.5	5x4.5x3.25	6.5x2.5x1.8
Weight (ounces)	12.9	12	15	13.9	21.5	13.7
Battery	(3) AA	(4) AA	(4) AA	(6)AA	(4)AA	(4)AAA +(4)AAA for LCD
Write Time	10 sec	4 sec	12 sec	30 sec	8 sec	5 sec
Transfer Time (sec/image)	25 sec	15 sec	30 sec	105 sec	45 sec	90 sec
Other Features			IrDA	Audio	Spot Meter	
Boot Verdict	8	7	9	2	10	6

required in all but open sunlight, the hands of a neurosurgeon are required to get clear pix.

MANUAL FEATURES

While many people prefer the simplicity of point-and-click operation, it limits how you can use a camera. Lowlight, backlight, high-speed action, selective focus, and close-ups all require manual control features. Film SLRs and more sophisticated point-and-shoot cameras can set shutter speeds, apertures, and focal points. The more versatile digital cameras, such as the Olympus D-600L, also have this sort of control. But even the best consumer-grade digital cameras still lack manual focus control. Heck, many of the cameras in this shoot-out don't even actually focus, opting instead for fixed or focus-free imaging. This method attempts to get everything generally in focus but really only succeeds in getting nothing truly in focus. Manual focus will be a much-anticipated feature in future offerings.

WRITE TIMES

This is the one you never see on the box, but it has a major impact on actually using a digital camera. Anyone familiar with using a film camera is accustomed to taking one picture and instantly being able to take another, pausing only to advance the film in simpler cameras. Digital cameras, on the other hand, require some time to write the image flashed onto the CCD into storage. This span varies based on the camera and the image file size, and can be relatively lengthy. The Umax MDX-8000 requires 30 seconds between clicks, and magic moments can be missed watching some infernal LED flash its progress. The fastest camera in this shoot-out was the Fuji DX-7, whose brief 4-second pause is completely tolerable. Still, it'd be great if future cameras had some form of parallel processing that would allow multiple images to be held in a buffer until time was available to write the image to memory.

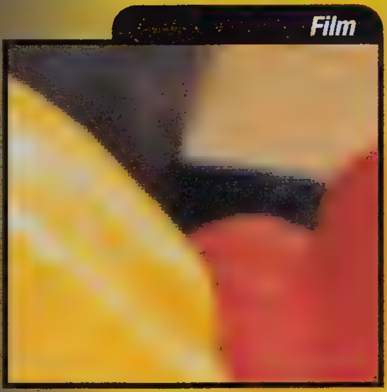
WHAT TO BUY

If you have the jingle, Olympus's D-600L is a no-brainer. This camera represents the consumer-grade digital camera's first strides toward SLR-caliber features and performance.

If you're looking to stay under the $1,000 mark, consider Kodak's excellent DC210. The resolution falls just short of Olympus's offering, but for ease of use and quality images, this camera has few competitors.

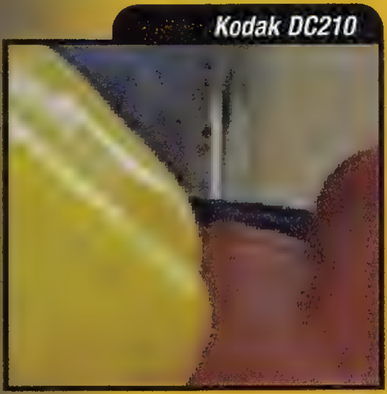
Dipping below the $500 mark, the best of this shoot-out is a toss-up between the Fuji DX-7 and the Canon PowerShot 350. The Fuji boasts bright, appealing color, but at the expense of the crisp detail found with the Canon.

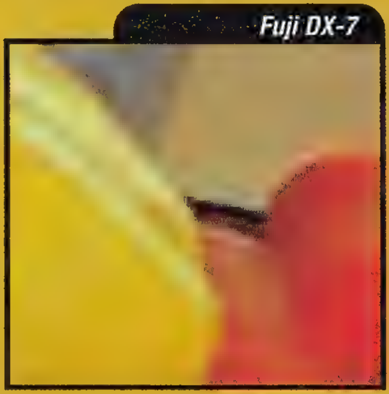
ARTIFACTING

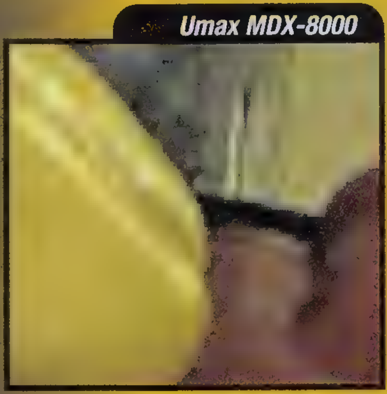

Film

The JPEG compression scheme used by nearly all digital cameras is lossy, so artifacts (clumps of image data that attempt to fill in the holes) always occur. The difference is with how aggressively compression is applied. Instead of switching resolutions for various memory settings, most cameras merely turn up the JPEG ratio.

A perfect example of this travesty is the clumping evident in the images by Umax's MDX-8000. Zooming in reveals a surreal mosaic of small horizontal and vertical defects reminiscent of the pattern on a parquet floor.


Kodak DC210


Fuji DX-7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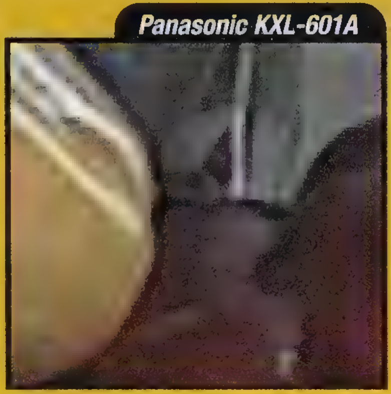
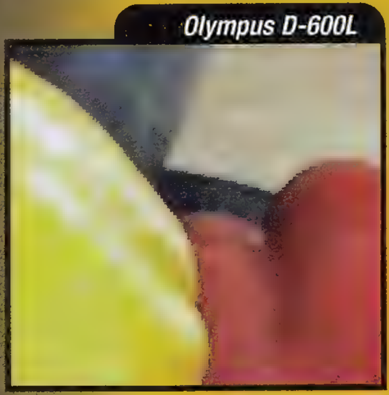
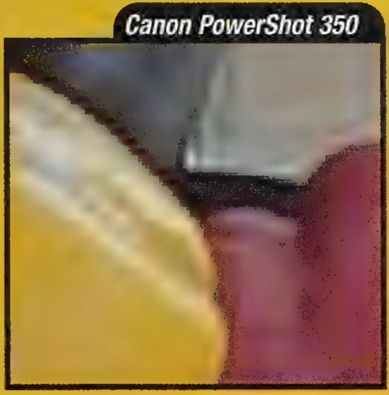

Panasonic KXL-601A


Olympus D-600L


Canon PowerShot 350

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CHECKPOINT

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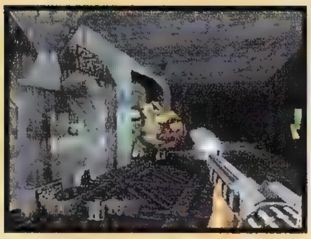
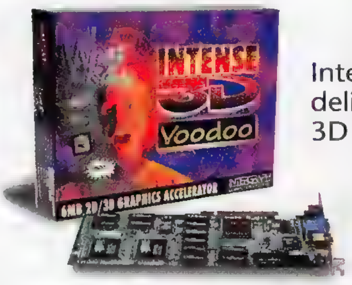
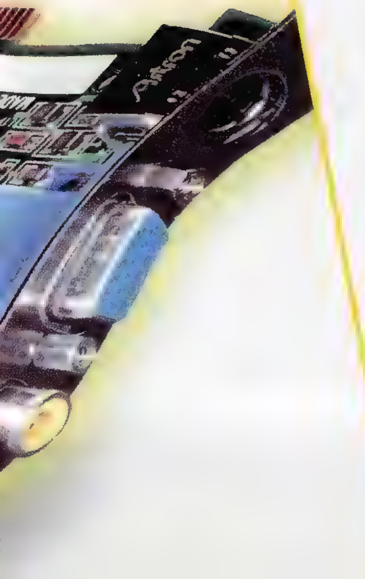


Turok: Dinosaur Hunter

Longbow FX



Intense 3D Voodoo delivers arcade-quality 3D graphics on *your* PC.



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YOUR PERSONAL TECH **BRIEFING** ON THE **CONCEPTS** AND **COMPONENTS** THAT MAKE UP THE **PC** EXPERIENCE

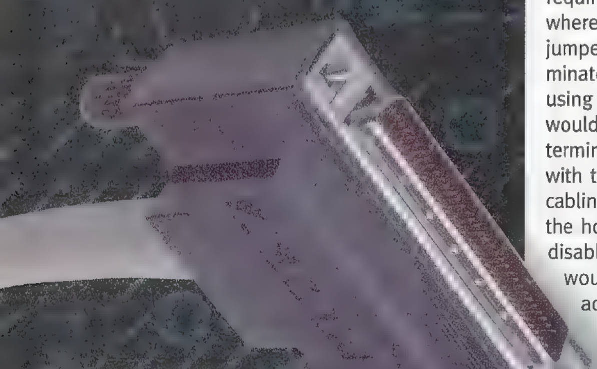
this month:

SCSI

SCSI-1, SCSI-2, SCSI-3, Fast SCSI, Fast Wide SCSI, Ultra SCSI, Ultra Wide SCSI, Ultra2, FC-AL, and SSA. Confused? Read on!

—Sean Cleveland

The DB25 is a 25-pin SCSI-1 connector generally used on Macintosh and IBM PS/2 computers.



The half-pitch, high-density DB-68 external SCSI cable uses 68 pins and comes with molded ends using Micro D connectors with thumbscrews. Cable lengths generally run in 3-, 5-, and 6-foot lengths. Ultra2 LVD versions of this cable can reach up to 12 meters.

SCSI IN A NUTSHELL

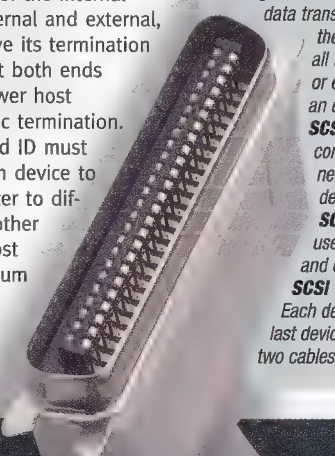
SCSI stands for Small Computer System Interface, but it's anything but small. This high-speed parallel interface standard grew from a 20-page specification in 1980 into a complex, 600-page ANSI standard. Keep in mind, though, that no clear standard exists for any of the SCSI flavors and that those flavors are constantly evolving and expanding. SCSI is perfectly suited for true multitasking environments such as Unix and Windows NT because of its ability to manage large storage devices such as hard drives and access devices concurrently. In fact, NT supported only SCSI devices when it first came out. Not all computers have SCSI ports, though. It comes standard on most Macintoshes but requires an expansion board or host adapter in most PCs.

The most confusing aspect of SCSI is device speeds versus bus speeds. When hard drives are advertised to run at 40MB/sec, manufacturers mean the maximum potential of the SCSI architecture they've been built for. They're talking about an aggregate throughput on the bus or the total amount of information that can be pumped through the physical wire. You won't see hard drives that can really transfer at 40MB/sec for some time (Seagate's Cheetah is the fastest so far, and it barely breaks the 10MB/sec mark).

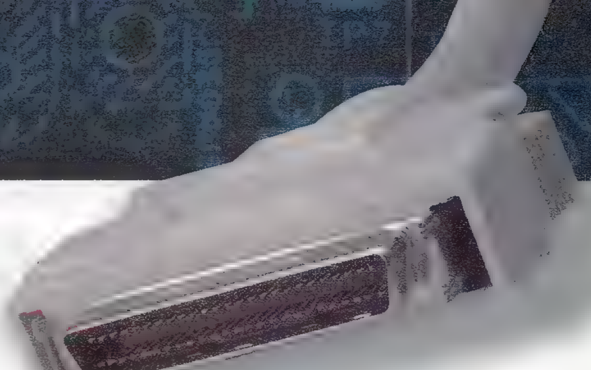
TERMINATION AND IDS

The secret of SCSI is complete mastery of the elusive art of termination. Anything less than perfection guarantees failure. Devices on a SCSI bus are connected serially with SCSI cables. The first and last devices on the SCSI bus must have a set of resistors called terminators. Older SCSI devices required an actual resistor to be attached, whereas newer ones are set with a switch or jumper. All other devices must have their terminators disabled or removed. So, if you were using internal SCSI devices exclusively, you would make sure the host adapter itself was terminated (usually done within BIOS), along with the device at the end of the internal cabling. If running both internal and external, the host adapter would have its termination disabled and the devices at both ends would be terminated. Newer host adapters have automatic termination.

A differently numbered ID must be assigned to each device to allow the host adapter to differentiate them from other devices. Narrow SCSI host adapters can have a maximum of 8 SCSI IDs on the same bus, and Wide host adapters can have a maximum of 15. The host adapter itself requires an ID and is almost always assigned 7 by default.



The Centronics Cen50 is a 50-pin SCSI-1 connector that uses bail clips. Cable lengths generally run 1.5, 3, and 6 feet in length.



The half-pitch, high-density DB-50 external SCSI-2 cable uses 50-pins and comes with molded ends using Micro D connectors with spring clips. Cable lengths generally run 3 and 6 feet in length.

SCSI can be terminated using various types of terminators. A Passive Terminator should be used if the total chain distance is less than 6 feet and I/O speed is 10MB/sec or less. An Active Terminator should be employed if SCSI-2 and SCSI-3 devices are used and the total length of the chain is 20 feet or less. A Forced Perfect Terminator (FPT-18) is recommended if the total distance is more than 20 feet and high-end SCSI-3 devices are used. Active terminators use voltage regulators to produce termination voltage, whereas passive terminators use two resistors for each signal line as voltage dividers, providing blocked signal reflections without controlling the voltage. Regulated or Differential Terminators are used only when using Differential devices and host adapters.

SCSI Definitions

Bus Mastering: *A high-performance way to transfer data. The host adapter controls the transfer of data directly to and from system memory without overloading the CPU. This is the fastest way for multitasking OSes to transfer data.*

DMA Bus Master: *A feature that allows a peripheral to control the flow of data to and from system memory by blocks, as opposed to Programmed I/O (PIO), where the flow is by byte.*

Multi-Threading: *The simultaneous accessing of data by more than one SCSI device. This increases data transfer rates.*

Parity Checking: *A way to verify the accuracy of data transmitted over the SCSI bus. One bit in the transfer is used to make the sum of all the 1 bits either odd or even (for odd or even parity). If the sum is not correct, an error message appears.*

SCSI Port: *A SCSI host adapter within a computer, which provides a logical connection between the computer and all devices on the SCSI bus.*

SCSI Device: *A peripheral device that uses the SCSI standard to exchange data and control signals with the CPU.*

SCSI Chain: *A set of devices on a SCSI bus. Each device (except the host adapter and the last device) is connected to two other devices by two cables, forming a daisy chain.*

SCSI Specifications

SCSI Terminology	Bus Speed (MB/sec)	Bus Width (Bits)	Maximum Cable Length (Meters) (SE)	(HVD)	LVD	Devices Supported (Max. Number)
SCSI-1	5	8	6	25	-	8
SCSI-2, Fast SCSI	10	8	6	25	-	8
SCSI-3, Ultra SCSI	20	8	1.5	25	-	8
SCSI-3, Ultra SCSI	20	8	3	-	-	4
SCSI-3, Fast Wide SCSI	20	16	6	25	-	16
SCSI-3, Wide Ultra SCSI	40	16	-	25	-	16
SCSI-3, Wide Ultra SCSI	40	16	1.5	-	-	8
SCSI-3, Wide Ultra SCSI	40	16	3	-	-	4
SCSI-3, Ultra 2 SCSI	40	8	-	12	12	8
SCSI-3, Ultra 2 SCSI	80	16	-	25	25	2
SCSI-3, Wide Ultra 2 SCSI	80	16	-	12	12	16
SCSI-3, Wide Ultra 2 SCSI	80	16	-	25	25	2

CONNECTORS

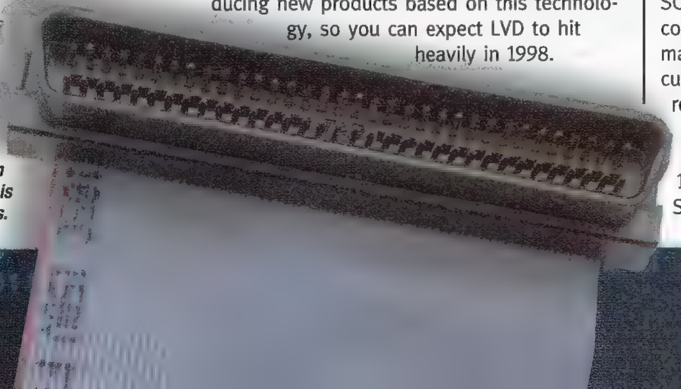
SCSI connectors have changed throughout the evolution of SCSI technology, and each new spec required more data paths, better materials, and newer, more efficient architectures. The total number of pins has increased from 25 to 68, and the distance between each pin (the pitch) was changed from 2.77mm for regular D-Sub connectors to 1.27mm for Half-Pitch (HP) connectors. It was then reduced again to 0.8mm for Very High Density (VHD) Centronics connectors to accommodate smaller devices such as those in notebooks.

TRANSCEIVERS

The type of SCSI transceiver used determines the maximum bus length and total number of devices supported. Until recently, two different types of transceivers were used: Single-Ended and Differential. Although most SCSI devices use Single-Ended transceivers, increased bus speeds have shortened bus lengths. High-powered Differential transceivers overcome bus-length limitations but have shortcomings as well. Single-Ended signal transmission requires all data and handshaking signals to draw the necessary current through a common ground, generating "noise" in the bus. This noise creates problems such as performance degradation. Single-ended SCSI-1 utilizes a maximum bus length of 6 meters, halved proportionally by each incremental increase in bus speed.

SCSI-2 introduced signal pairing using High-Voltage Differential (HVD) SCSI. Its advantages include better termination due to lack of noise, a significant bus length increase to 25 meters at any bus speed, and performance enhancements. Although you can use any Single-Ended cabling, you can't mix Differential devices with Single-Ended devices on the same bus. Their terminators are also electronically different. The biggest drawback of Differential SCSI is the lack of availability of slower devices such as tape backup and CD-ROM drives. The increased power required by HVD chips prevented Differential SCSI from being integrated in controller chips, thus increasing costs of Differential controllers and ultimately prohibiting its widespread use.

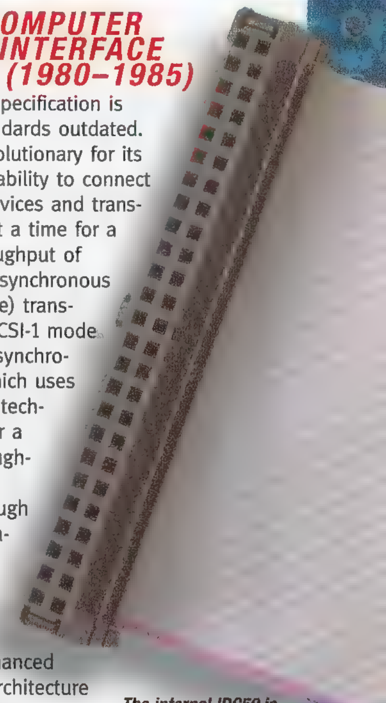
A new transceiver technology, Low-Voltage Differential (LVD) is currently poised to overcome these downfalls and offer the best of both Single-Ended and Differential transceivers. The new Ultra 2 spec incorporates LVD technology. The biggest bonus of LVD is its lower power consumption. Integrated into a controller chip, it maintains the advantages of differential signaling. LVD also enables higher bus speeds—up to 80MB/sec in the Wide version. Ultra 2 LVD controllers can be multimode—able to automatically support both older Single-Ended and LVD devices on a single bus. But keep in mind that if older Single-Ended devices are added to an LVD bus, the bus length is reduced to Ultra SCSI standards and the bus speed is halved. Most SCSI host adapter manufacturers are adding a dedicated bus for Single-Ended devices to get around this problem (Adaptec and Diamond for sure). All major SCSI developers are introducing new products based on this technology, so you can expect LVD to hit heavily in 1998.



The half-pitch DB68 is a 68-pin SCSI-3 connector that uses the SCSI-3 hard drive flat ribbon cable. Ultra 2 LVD versions of this cable can reach up to 12 meters.

SMALL COMPUTER SYSTEM INTERFACE (SCSI-1) (1980–1985)

The first SCSI specification is by today's standards outdated. SCSI-1 was revolutionary for its time, with the ability to connect up to seven devices and transferring 8 bits at a time for a total data throughput of 5MB/sec using synchronous (streamed mode) transfers. Another SCSI-1 mode of transfer is asynchronous mode, which uses a handshaking technique to deliver a maximum throughput of only 3MB/sec. Although the first incarnation of SCSI faced stiff competition with the already entrenched Enhanced Small Device Architecture (ESDI) drives; the promise of SCSI-2 and its performance enhancements was enough to overcome its underdog standing.



The internal IDC50 is a 50-pin SCSI-1 connector that uses the SCSI-1 ribbon cable.

SMALL COMPUTER SYSTEM INTERFACE 2 (SCSI-2) (1986–1992)

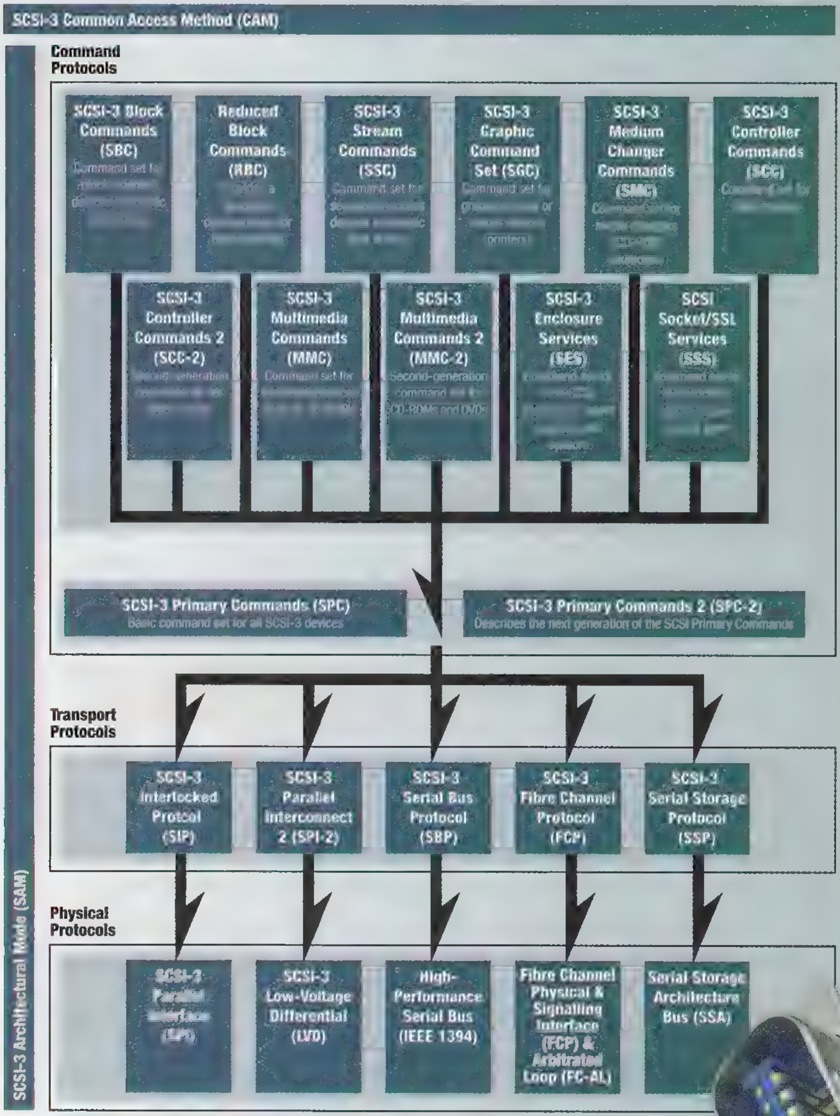
The SCSI-2 spec contained new, improved command sets and enhanced and optimized older ones. Active termination boosted system integrity, and several new commands and diagnostics capabilities extended on the Read/Write buffer and Read/Write Long commands. Optional messages were added to negotiate wide transfers to support command queuing, and sense keys and sense codes were also formalized and extended. SCSI-2 widened the data width to 16 bits, as well as the speed. And, of course, it's backward compatible with SCSI-1 devices.

Command Tag Queuing, a feature of SCSI-2, allows devices to immediately accept and execute other commands while data that's already been read or written is sent back up the bus to the SCSI host adapter. This is a powerful performance advantage over ATA. A SCSI-2 adapter can execute 256 concurrent commands; SCSI-1 is limited to a single command. It also lets the device controller execute commands in a different order than received, improves performance significantly.

SCSI-2 also includes Fast SCSI, which can transfer data 8 bits at a time at up to 10MB/sec on a 50-pin connector. But Single-Ended Fast SCSI-2 transfers rarely

Small Computer System Interface 3 (SCSI-3)

The SCSI-3 Architectural Model (SAM) defines a common set of functions, services, and definitions for how a physical transport properly exchanges commands, data, and status between two devices, complete with error handling and queuing.


SCSI-3 Common Access Method (CAM)
Command Protocols
SCSI-3 Block Commands (SBC)
Command set for
Reduced Block Commands (RBC)
SCSI-3 Stream Commands (SSC)
Command set for
SCSI-3 Graphic Command Set (SGC)
Command set for
printers
SCSI-3 Medium Changer Commands (SMC)
SCSI-3 Controller Commands (SCC)
SCSI-3 Controller Commands 2 (SCC-2)
Second-generation
SCSI-3 Multimedia Commands (MMC)
Command set for
SCSI-3 Multimedia Commands 2 (MMC-2)
Second-generation command set for CD-ROMs and DVDs
SCSI-3 Enclosure Services (SES)
SCSI Socket/SSL Services (SSS)
SCSI-3 Primary Commands (SPC)
Basic command set for all SCSI-3 devices
SCSI-3 Primary Commands 2 (SPC-2)
Describes the next generation of the SCSI Primary Commands
Transport Protocols
SCSI-3 Interlocked Protocol (SIP)
SCSI-3 Parallel Interconnect 2 (SPI-2)
SCSI-3 Serial Bus Protocol (SBP)
SCSI-3 Fibre Channel Protocol (FCP)
SCSI-3 Serial Storage Protocol (SSP)
Physical Protocols
SCSI-3 Parallel Interface (SPI)
SCSI-3 Low-Voltage Differential (LVD)
High-Performance Serial Bus (IEEE 1394)
Fibre Channel Physical & Signalling Interface (FCP) & Arbitrated Loop (FC-AL)
Serial Storage Architecture Bus (SSA)
SCSI-3 Architectural Mode (SAM)

achieve those speeds, often dropping to slower asynchronous speeds due to transmission noise. The ANSI committee recommended using Differential SCSI when it drafted the Fast SCSI-2 spec. Cable length should be limited to 3 meters (total internal and external cable lengths), and Fast SCSI-2 devices residing on the same bus should be plugged into the same 115V AC (ground) source, configured with Micro-D connectors, and terminated with Forced Perfect Termination.

SCSI-3 PARALLEL INTERFACE (FAST-20) (1993–1996)

SCSI-3 is really an entire family of standards containing different layers and command sets to define other physical transport layers separately from other projects.

SCSI-3 also includes the following:

Wide (Fast) SCSI: Fast Wide SCSI can transfer data 16 bits at a time at up to 20MB/sec on 68 pins. Wide SCSI extends the parallel, 8-bit SCSI data path to 16 and 32 bits. Single-Ended and Differential SCSI methods are both supported, although the Single-Ended implementation is discouraged. The total number of devices was also increased to 16 due to the new 16-bit architecture, and the new interconnect technology extended this by 4x per PCI slot, thus, quad-channel controllers can connect up to 64 devices.

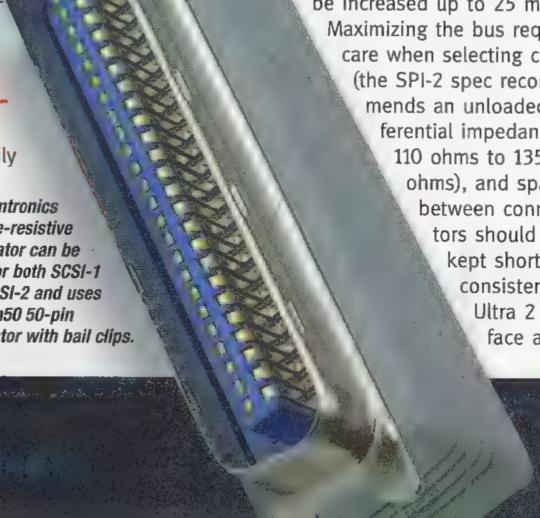
Ultra SCSI: Ultra SCSI is the basis for current and future SCSI developments. It's a double-clock-speed of Fast SCSI-2 disk drive technology. It uses standard SCSI cables and connectors, and Ultra SCSI drives work with Fast Wide host adapters. The data bursts and overall bus throughput are doubled from 10MB/sec to 20MB/sec on an 8-bit connection. These improvements and cycle times were a direct result of new semiconductor technologies.

Ultra Wide SCSI: Ultra Wide SCSI doubles the overall bus speed of Fast Wide SCSI to 40MB/sec using a 16-bit connection.

SCSI PARALLEL INTERFACE 2 (SPI-2) (1997–2000)

Also called Ultra 2 SCSI, this is part of the SCSI-3 spec and uses new LVD signal filtering to reduce bus noise and improve data reliability. The Ultra 2 bus is a multipoint bus that can have up to 16 devices connected to it with a maximum bus length of 12 meters. If the bus is set up using a point-to-point (two devices—target and initiator) configuration, the cable can be increased up to 25 meters. Maximizing the bus requires care when selecting cable (the SPI-2 spec recommends an unloaded differential impedance of 110 ohms to 135 ohms), and spacing between connectors should be kept short and consistent. The Ultra 2 interface also

The DB25 is a SCSI-1 passive terminator that is used primarily on Macintosh and IBM PS/2 computers.



The Centronics passive-resistive terminator can be used for both SCSI-1 and SCSI-2 and uses the Cen50 50-pin connector with bail clips.

increases the data rate over the bus, doubling it to a maximum speed of 80MB/sec. Upgradability of the existing SCSI has been maintained, and the physical interface should allow easy migration to even higher data rates in the future. Ultra 2 is considered the new standard that will carry SCSI into the next millenium.

SCSIVue
REQ
ACK
SEL
TRM

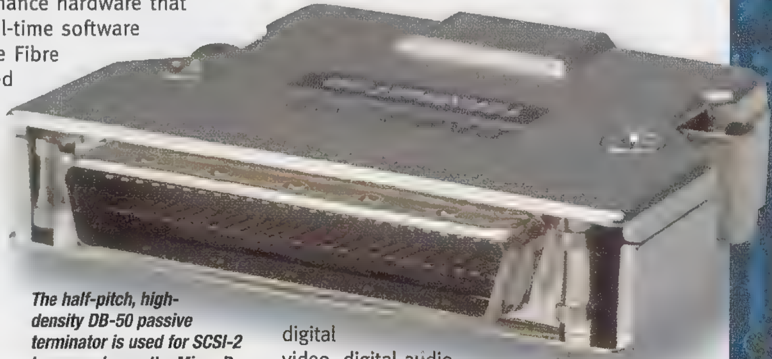
The DB-68 SCSI-3 Forced Perfect Terminator is an excellent tool for diagnosing SCSI-bus-related problems. It includes LED lights that show Request (REQ), Acknowledge (ACK), Select (SEL), and Termination Power (TRM).

SERIAL STORAGE ARCHITECTURE (SSA) BUS

SSA is an interface specification from IBM—and part of the SCSI-3 spec—with data transfers of 80MB/sec (40MB/sec reads and 40MB/sec writes). It uses a dual (loop) bus structure for high availability and automatic configuration of termination and SCSI IDs. Cable length is effectively increased to 20 meters, with less line degradation, and is hot swappable. SSA was considered to be the next popular SCSI specification but seems to have been beaten out by Ultra 2 LVD and Fibre Channel.

FIBRE CHANNEL PHYSICAL AND SIGNALING INTERFACE (FC-PH)

Fibre Channel is a subset of the Fibre Channel network systems interconnection standard adopted by the ANSI board and is a part of the SCSI-3 spec. This high-speed serial architecture allows either optical or electrical connections at data rates up to 4Gbps. The topologies supported by Fibre Channel include point-to-point, fibre switched, and arbitrated loop. The architecture has been designed to work with high-performance hardware that requires little real-time software management. The Fibre Channel Arbitrated Loop (FC-AL) is an alternative implementation that uses the FC mechanisms to transfer data between drives selected by the arbitration process and any of the other drives on the loop.



The half-pitch, high-density DB-50 passive terminator is used for SCSI-2 buses and uses the Micro D connector with spring clips.

Troubleshooting SCSI Connections

Always check termination first. Remember that devices on the ends of the SCSI chains (or the host adapter if using only internal or external) must be terminated and that every other device must have termination disabled for the SCSI bus to work properly.

Don't use poor-quality cables such as printer type RS-232 cables. The best are CL2 Madison cables, manufactured using double shielded (using foil and braid) twisted pair wiring.

No two devices can be assigned the same SCSI ID. This includes devices connected both internally and externally. Remember that the host adapter is usually assigned ID 7 by default, so make sure no other devices are assigned ID 7 as well.

Use the shortest connections possible. Make sure your total cable length, including both internal and external cables, does not exceed the maximum length (see the Interface Technology table for specifics).

Never use cable unions to extend cable lengths and never connect devices in a star configuration. Always connect them in a straight line.

Make sure your host adapter adheres to the Advanced SCSI Programming Interface (ASPI) specification. This is a common structured method of supporting SCSI peripherals. It provides an interface between host adapters and SCSI device drivers.

Are the cables plugged in properly? The alignment of pin-1 on a SCSI cable connector and the pin-1 position on the SCSI connector into which it is inserted must be correct. External cables are keyed to ensure proper alignment, but a lot of internal cables are not.

Is SCAM turned on? This acronym stands for SCSI Configured AutoMatically. It is a method to automatically allocate SCSI IDs via software when SCAM-compliant SCSI devices are attached. If you are not sure whether a device is SCAM compliant, turn it off.

The most common (and toughest to correct) problem is a conflict with another peripheral in your computer. This occurs when the host adapter is assigned a Port Address or Interrupt (IRQ) that has already been taken by another peripheral. Software, including Norton Utilities, *Helix's* Nuts & Bolts, *and Touchstone's* Check-It, *is available to help with this.*

HIGH PERFORMANCE SERIAL BUS (IEEE 1394)

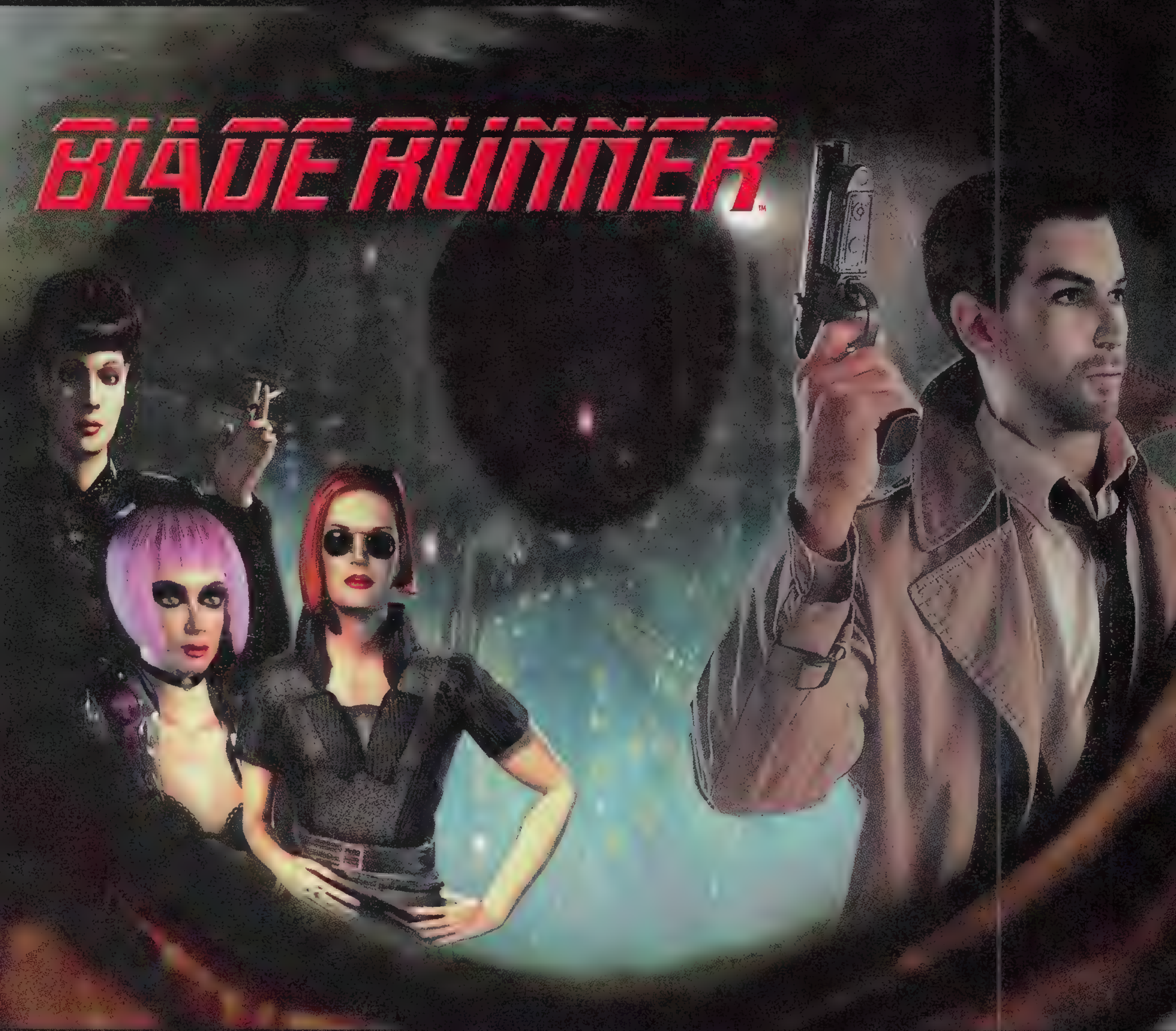
The IEEE 1394 High Performance Serial Bus is a versatile, high-speed, and low-cost method of interconnecting computer peripherals, storage systems, and consumer electronics devices.

It's serial bus is designed for efficient, peer-to-peer operation of devices such as disks, tapes, printers, and digital cameras. The benefits of serial interconnect include cost reduction and better performance over the parallel interconnects first utilized by SCSI. It can transfer at speeds of 100Mbps (12.5MB/sec), 200Mbps (25MB/sec), and 400Mbps (50MB/sec) using both isochronous (guaranteed bandwidth) and asynchronous transfers. It uses small connectors and supports hot plugging and the automatic configuration of IDs and termination. The total number of devices handled is 63 (16 daisy chained) on a 4.5 meter flexible cable and seems to be geared primarily at storage drives, digital video, digital audio, DVD players, and digital cameras. 1394 is analogous to Apple's FireWire and is currently available in retail stores.

SCSI PARALLEL INTERCONNECT-3 (SPI-3) (2000+)

The next SCSI spec, Ultra 3, is already being outlined. It'll be a second-generation LVD technology allowing a dual-channel host adapter to attain greater than 5Gbps data rate, effectively quintupling the data rate of current serial technology. This will allow peripherals to meet the data I/O needs of the next generation 64-bit processors being delivered by the end of the millennium. In addition to improving the fundamental data rate to 80 mega-transfers per second, SPI-3 will significantly reduce the overhead of parallel SCSI with the adoption of protocol enhancements allowing a host adapter achievement of greater than 100,000 I/Os per second. Enhancements include an error detection scheme with packetization that will increase data integrity and provide unrestricted hot plugging for parallel SCSI. SPI-3 will also deal with the advancing developments in silicon technology related to power management and voltage reduction.

THE FIRST REAL-TIME 3D ADVENTURE
BLADE RUNNER FOR THE PC



The most talked about sci-fi movie of all time has come to the PC. And your PC will never be the same again. Armed with your investigative skills and the tools of a 21st century BLADE RUNNER ™, you'll be immersed in a futuristic world that revolutionizes computer gaming, and tests your ability to survive in one of the richest and most atmospheric games ever created for the PC. Are you ready?

TEEN T AGES 13+ CONTENT RATED BY ESRB

Westwood

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Product Information Number 341

IRQS ACTING UP? VIDEO **DRIVERS** GETTING YOU **DOWN**? 3D CARDS HAVE YOU CAUGHT IN A **CONUNDRUM**? BOOT **EDITORS** ANSWER YOUR TOUGHEST **PC QUESTIONS**.

A New Registry in Three Simple Steps

In the *boot* 16 Clinic you had a reader with registry corruption problems who was lucky enough to have an uncorrupted copy of his registry to fall back on. I've seen many situations in which the user isn't so lucky. There is a relatively simple solution to registry-related problems: Rebuild the registry itself with REGEDIT. To do this, restart the computer in MS-DOS mode—REGEDIT will do only what you need it to do in DOS mode while the registry is closed.

1) Export the current registry into a text file by running the following from within the Windows directory:

```
REGEDIT /L:SYSTEM.DAT /R:USER.DAT /E FULLBAK.REG
```

This will force REGEDIT to parse the registry and dump its raw contents to the text file FULLBAK.REG.

2) Make a backup directory and *move* your USER.DAT and SYSTEM.DAT into that directory so REGEDIT cannot find them. (This step is just a precaution. I've never seen a situation where this trick doesn't work, but there's always a first, and now you'll have a backup.)

3) Recreate the registry by moving back to the Windows directory and running the command:

```
REGEDIT /L:SYSTEM.DAT /R:USER.DAT /C FULLBAK.REG
```

Reboot and voila! A registry free of corruption (but not necessarily free of dead wood).

—Aaron Heck

"How to Mate Motherboards and Win95 in the Wild" by Your Friendly Neighborhood SysAdmin

This is regarding the guy who installed a new motherboard and his PC locked up on Windows 95 boot-up (*boot* 16 Clinic). I work for an OEM and hear about these problems all the time. Running a previously installed Win95 on a different motherboard can sometimes cause problems that wouldn't have occurred had the proper preparation been done. I install Win95 about 50 times a week on average and share some installations on different computers with removable hard drive caddies.

The best way to change out a motherboard is to delete all devices in Device Manager, shut down, and then replace the board. Most times, removing "Plug and Play BIOS" will get rid of 95% of all devices. You can then delete the rest manually, one at a time, if you wish to be thorough. (Hint: Do the mouse last!)

> *I have an icon on my desktop for when I get tired of a **bloated install**. I just click it, and it deletes my Windows and program files dirs, and reinstalls the OS, IE4, and all my apps.*

My favorite method, however, requires registry editing. I just run REGEDIT.EXE, go to HKEY_LOCAL_MACHINE, and delete the whole Enum key. That does the trick nicely. Take a look at Device Manager if you don't believe me. When you come back up with your new motherboard installed, you'll be prompted to redetect all hardware, and the resulting setup is usually much cleaner.

Another related trick is to save different configurations to registry export files. I use this when I have to use different motherboards but keep the same Win95 install. I just run REGEDIT.EXE, highlight the Enum key, pick Registry/Export to File, and save under some name I hope to remember later. The file has a .REG extension and can later be imported. A quick motherboard swap would be to:

1) delete the Enum key
2) reboot
3) hit F8 and go Command Prompt Only
4) run REGEDIT FILENAME.REG (import the motherboard-specific file)
5) type win to continue booting to the GUI. The proper drivers are loaded since it was necessary to have them locally installed when the export file was made. Just copying the .REG file to another PC wouldn't work too well.

One last consideration when installing a new motherboard is that the Win95 Virtual Machine Manager is created during setup for *that particular board*. If you need more proof, break out of the first reboot during setup (F8/Command Prompt), go to the Windows dir and type edit wininit.ini. This is the list of to-dos that will happen as soon as WIN.COM is called by the IO.SYS bootstrap. You can even just type wininit at this point and hear the grinding. The familiar "Windows is updating... this may take a few minutes..." line will appear here—a function of WININIT.EXE, the point being that all those VXDs are being crunched into VMM32.VXD, which is the heart of Windows and is mostly machine-specific. So, in order to create a snappy and super-stable new install (without having to deltree /y c:\windows), re-run setup after doing a little housework. This involves the following:

1) copy \win95 directory from the win95 cd to your hard drive (easier and faster)
2) delete the Enum key
3) reboot and go to Command Prompt
4) go to \windows\system dir and delete *.vxd
5) deltree /y \windows\system\iosubsys \windows\system\vmm32
6) rerun setup

Note: Some apps do install VXDs (like CD-recording software), so you'll have to reinstall them, but at least you keep all your settings. Also, you must uninstall Internet Explorer 4.0 before even starting a procedure like this.

I have an icon on my desktop for when I get tired of a bloated install. I just click it, and it deletes my Windows and program files dirs, and reinstalls the OS, IE4, and all my apps. It even sets up my mail and Internet access for me! I suspect you guys reinstall a lot, too. Hmm, maybe I have too much time on my hands...

—John Eccles

The Truth About PCIsets and EEPROM

After reading the review of the AsusTek P2L97 Pentium II motherboard in *boot* 15, I knew I had to have it. But on some Web sites I see disclaimers that say there is special memory that works only with Asus motherboards, especially the P2L97. I have e-mailed many of these sites and in return have been told I need SDRAM with EPROM. What's that? And what kind of RAM do you recommend for use on the P2L97?

—Stefan Huber

Hardware editor Andrew Sanchez replies: *What they are referring to is the fact that the 440LX PCIset requires memory manufacturers to program an EEPROM chip with SPD (Serial Presence Detection) on the module in order for the BIOS to program the 440LX's timing registers properly. Check for a small EEPROM chip sitting in one of the top corners of the memory module. The P2L97 specs are as follows: two 168-pin DIMMs, 386MB of total system RAM, requires 3.3V unbuffered Synchronous DRAMs or EDO DRAM of either 8, 16, 64, 128MB pieces. If you want to use the 440LX Error Checking and Correction (ECC) features, you must use a DIMM module with nine chips per side (standard 8-chip plus one parity chip) and make the proper BIOS settings.*

Who's the Boss?

I have a Gateway P5-100 that I bought in August of 1995. Since then, I added more memory and a second drive, and replaced the CD-ROM with an 8x. I have two hard drives coming off one IDE cable, and my other one controls the CD-ROM. I added a 500MB drive to the second cable, but used the second slot on the cable. Everything works fine. My settings detect my first two drives, then the CD-ROM, then the other hard drive. My problem is when I do a warm boot I loose the third hard drive. What's going on?

—Joshua Drew

Disc editor Sean Cleveland replies: *I suggest switching the order of your CD-ROM and your 500MB hard drive on your secondary bus. Make the hard drive the Master device and the CD-ROM drive the Slave. Some older BIOSes do not detect ATAPI CD-ROM drives properly, and you may be running into this now that you have recently* *upgraded. It may be a good idea to check with Gateway on the availability of an updated BIOS.*

The Old OS Switcharoo

How do you get a DOS program such as a CD-ROM driver to be fooled into thinking that a Win95 machine is really running DOS 6.0 or higher instead of Windows 95? I recently installed an NEC CD-ROM drive from a Packard-Bell desktop PC. Win95 recognizes it without a problem. But I have some DOS-only games that won't run with the NEC CDR271 driver I downloaded from the Packard-Bell site. Packard-Bell wants me to use its toll tech support, and NEC says I have to go through Packard-Bell because they're the OEM for this drive. Got any advice?

—Dave

Disc editor Sean Cleveland replies: *I don't know of any third-party software that will offer you a solution in a pure DOS environment. You might have better luck modifying the MS-DOS properties of the DOS-only game you're using in order to run from within Windows 95. Make a shortcut of the game's executable and then edit its Properties (accessed via a right-click). Once there, click on the Program tab and then the Advanced button on the bottom of that dialog for configuration options. You will want to uncheck the "MS-DOS mode" box and check the "Prevent MS-DOS-based programs from detecting Windows" box. Some games that can be run this way include* Wing Commander IV *and* Privateer 2.

Nary a Win95 Question in the Bunch

I need some answers.

1) Will Windows 98 support multiprocessing?
2) Does the current Windows NT Workstation Version 4 fully support DirectX 5?
3) How can I load my scanner in Windows NT (my scanner requires a DOS driver)?

—Francis Tan

Software editor Sean Downey replies:
1) Win98 is just another update to the old Win3.1/Win95 code. The core OS modules can't be expanded to take advantage of multiple processors without losing support for legacy software. You'll need to run NT and an application specifically written to take advantage of multiple processors in order to get that kind of support from a Microsoft OS.
2) Service Pack 3 was supposed to bring full DirectX 3.0 support to NT 4.0, but Direct3D support didn't quite make it in. Combine this with the lack of NT-specific drivers for many 3D cards, and you've got an OS that isn't quite game ready.
3) The DOS driver won't do much good in NT. You'll need a driver specifically designed for NT 4.0.

Domestic Violence

A warning to all *boot* readers: NEVER strike your computer out of ANGER. I recently learned that awful lesson. I am 15 and have my own computer. Three days ago, I accidentally clicked on the floppy drive in Windows Explorer, causing my broken floppy drive to have a spaz. It wouldn't stop reading. So in anger, I struck it... KA-CHUNK. That was the sound made by my Maxtor 2.7GB hard drive that rests just below my floppy drive. All of a sudden it started making funny noises. I thought "Oh no!," and quickly restarted my computer. The first time it didn't read my hard drive at all, but the second re-boot made it to Win95. Phew, I thought, what a relief. But, nope, it started making funny noises again and locked up. I managed to use a Win95 boot disk to get to a command prompt. My D:, E:, F:, and G: drives weren't damaged, so I installed Win95 to D: but still haven't recovered C:. It is obviously an internal error. If anyone at *boot* has any idea what is wrong, I would appreciate it if you would write me.

—Cam Tomlinson

Disc editor Sean Cleveland replies: *Striking your machine in anger can have a detrimental effect on your hard drive. It can throw the drive spindle off balance, damaging a drive head or scratching the disc platter, making that section of the drive unreadable. It appears this is what happened in your case. The fact that the drive still works is good. It's also fortunate that you know which part of the drive is damaged, but please realize that the life of your drive may have been shortened by the blow. You can scan the disk surface for errors and ultimately remap them using the ScanDisk utility in Win95 or another such as* Norton Utilities *or* Helix Nuts & Bolts. *And if the sector is damaged, the utilities will save the data elsewhere so that you can attempt to recover it.*

> A warning to all boot readers: **NEVER** strike your computer out of anger.

Is My ISP Slowly Trying to Kill Me?

I have a P75 with a Diamond Supra Express 33.6, but my connection is nowhere near 33.6Kbps. Sometimes I can get a 2.5K sustained transfer rate but it usually falls between 2K to 1K. I've had my modem tested, and it's just fine. My telephone service is not from the same city as my ISP, but it is still a local call. Do you think my ISP is the culprit, or is it my telephone service?

—Ed Coolidge

Executive editor Jon Phillips replies: *First, you are not getting bad performance. Sustained throughput of 2K per second equals out to 20Kbps; 2.5K per second is that much better. Fact is, 33.6Kbps modem users rarely if ever get the advertised speed. You may connect at 33.6Kbps, but this is just your ceiling for the particular session. Due to line noise, users often get throughput numbers about 10Kbps lower than what's celebrated on the product packaging.*

Since I don't know anything about the condition of your internal house wiring, the copper underneath your city streets, or the equipment owned by your ISP, I wouldn't hazard a guess as to where any bottlenecks may lay. But I will say this: Most spontaneous throughput problems can be traced to slow Web and FTP servers. When too many users try to download image files and demos from underpowered servers, throughput slows to a crawl for all. Quit the guesswork and invest in a little utility called Net.Medic *from VitalSigns Software (www.vitalsigns.com). It will tell you your exact throughput during downloads, identify bottlenecks along any part of your pipe from the remote server to your local motherboard, and even recommend hints to improve performance.*

And Wear Clean Underwear In Case You Get Hit by a Car

I run Win95 as my OS. I only feel clean if I wipe about once every two weeks. Is there any way that I can save my Start menu? The machine feels dirty to me when I look at the default Start menu after installing Windows.

—tims

Software editor Sean Downey replies: *Back up the Start menu directory in your Windows directory, then after reinstalling Windows, copy the backup over the new default that was created during reinstallation. Of course, all this is like saving the bones and throwing away the flesh—none of the links to the apps would work properly until you reinstall each app.*

If you still feel dirty after all this, try washing your hands every five minutes. Some very healthy people find this comforting.

DVD Me!

OK, I'm all hyped about DVD-ROM and ready to invest. I just ordered a P200 MMX and already have 64MB of memory. I want to buy video to pump my gaming and show DVD Video-out to TV. Will the TV-outs in a card like the ATI All-in-Wonder Pro handle DVD Video-out as well? Is there anything special to look for in a video card to ensure high-quality DVD movies and games? And what about audio? I already have a Sound Blaster AWE 64. Are there any sound cards that will give me 5.1 surround sound, or do I need to look at an external receiver?

—Xavier Ashe

Hardware editor Andrew Sanchez replies: *You must first decide on how you'll do your MPEG-2 decoding. If you go with a software DVD solution, you'll need a video card that provides motion compensation for DVD, such as ATI's All-In-Wonder Pro and others. If you go with an MPEG-2 hardware decoder, you should take the output from the decoder card and pipe that into your TV. Make sure you get a decoder card with the appropriate S-Video/Composite out connectors. As far as audio, there are no Dolby Digital 5.1 decoder cards, although Altec Lansing and others plan to come out with 5.1 Dolby Digital speaker solutions that include decoders on-board. Or, if you just want Dolby Pro-Logic Surround sound, go with the miro miroSurround (reviewed in* boot *11).*

Go Ahead, Play With Fire

I want to overclock my Intel Pentium 200MHz with MMX, but before I do, I would like to know the following: As there are only two jumpers to set the CPU/bus freq ratio and the documentation already specifies settings for four ratios (1.5, 2, 2.5, and 3), I assume there is no possibility of getting my 200MHz Pentium to run at 233MHz. Do you agree? That leaves overclocking at 225MHz (3x75), but while there is an entry for 75MHz in the bus-speed jumper-settings table (actually there are two entries, dependent on the type of a chip on the board), the doc specifically states that those settings are only for Cyrix or IBM 6x86-P200+. Is the manufacturer too cautious, and can I use the 75MHz setting with my Intel CPU? And would I really get a 225MHZ Pentium? Also, is there a possibility of damaging the Pentium?

Nick Dieltjes

Hardware editor Andrew Sanchez replies: *At 66MHz, when you do the ratio multiplication, 66x3 equals 198 (or 200MHz). So, at that system bus speed, you will not be able to overclock your Intel Pentium CPU past 200MHz. Regarding which CPUs can be overclocked at a 75MHz, the manufacturers are basically stating the facts. The 75MHz bus speed is for Cyrix's 6x86 parts, although a brave soul can try to push his Intel CPU past 66MHz system bus. As far as speed goes, your system will act like a 225MHz Pentium (give or take a MHz), and run at that speed. If you decide to make the 75MHz jump, there is a possibility of damaging your CPU. A word of warning before you try this: You'd better have tons of cooling for your CPU before trying this maneuver. Preferably, some type of Peltier cooler. If your system refuses to boot after making the overclocking adjustment, or your programs start to lock up or crash, then it may be time to ease up on that CPU.*

A Marked Man

I've been bootMarking my new Intel 233 MMX CPU, and the highest number I've gotten out of 20 runs is 61, but the number tends to vary from 58 to 61. Is this occurrence natural? And when you print bootMark scores in the magazine, do you print the highest score or an overall average?

Minh Hoang

Hardware editor Andrew Sanchez replies: *Yes, bootMark scores will vary a few points from run to run—such is the nature of electrons, and electricity, and chaos theory, and bunk like that. As far as printed scores, we take five scores and average them for the final bootMark score you see attached to each review.*

His Sound Card Became a Monster

Let's say I know this brash, young, good-looking guy—OK, maybe not so good-looking—all right, he's fat and bald—who strives to build a Dream Machine. Let's say this fella goes out and buys Diamond's Monster Sound card in order to emulate his gadget guru gods and their creation.

He goes home, places this wonderful device in his love chariot, and pulls out the vile ISA sound card like a thorn from a lion's paw.

Then he boots up and installs all the wonderful drivers to get it running. He hooks up his favorite digital joystick (Microsoft's Precision Pro) and is denied the satisfaction of cruising about in large, lovely robots at a 10% performance boost after tweaking out his BIOS for PCI. Why? Because the Monster Sound card is not compatible with a large majority of digital sticks. This is something he had thought the gadget guru gods would've warned him about.

So, with great haste, he retrieves his SB64 Gold and jams it back into his machine like a doctor injecting cancer into his patient's bloodstream, and tweaks his BIOS back to the previous state of ISA awareness.

So, you see and now feel his pain. What should he do? Does this fella go in search of a greater and better PCI sound card? Or does he continue with this blasphemy of both ISA and a Monster Sound PCI in his machine? Let me know. Those fat, balding, middle-aged guys don't have much to look forward to other than their machines.

Mike

> If you decide to make the **75MHz** jump, there is a **possibility** of damaging your CPU. A word of **warning** before you try this: If your system refuses to boot after making the **overclocking** adjustment, or your programs start to **lock up** or crash, then it may be **time** to ease up on that CPU.

Hardware editor Andrew Sanchez replies: *No, Mike, fat, balding, middle-aged guys do not have to put up with ISA activity sullying their dream machines. Diamond is aware of the problems with Microsoft's digital controllers and has put out a patch that directly deals with the dilemma. Have your buddy go to www.diamondmm.com/products/drivers/monster-sound.html, download the MS10511.EXE file, install it, and follow Diamond's direction. You—uh, I mean, your friend—should be rockin' and rollin' with digital controllers and the Monster Sound card in no time.*

Out of Control

Reading the "Control Freaks" feature in *boot* 17 brought one of my major problems to mind. I have a Dell Dimension XPS Pro200n that I recently reformatted with OSR2. I did this because my system got hosed from all the Try-B4U-Buy games you folks distribute...and from the different controllers I have installed. I have an AWE32, Thrustmaster ACM Game Card, Thrustmaster T2 Wheel and Pedals, Logitech Wingman Extreme, and a Gravis GamePad Pro.

The problem arises when my Wingman wants one driver installed, my GamePad Pro requires another driver, and my T2 requires the ACM card's speed to be just right. How can I tell all these drivers to be friends and play nice? I see it as an almost impossible task!

Kerry Saylor

News editor Bryan Del Rizzo replies: *Make sure you're using the latest drivers from each respective manufacturer and double-check your control panel/joystick applet settings. Some drivers overwrite the standard Win95 applet, while others merely integrate within it. Test the controllers under Win95, recalibrate the device if necessary, and make sure you've assigned the correct device to the controller ID# (1-16). Also, since you've installed a secondary gameport, make sure there isn't a conflict with the gameport on your sound card (you'll have to disable one of them).*

Buggy BIOS

I just purchased a 200MHz MMX system. I'm running Windows NT 4.0 with Service Pack 3 installed, and I can't get the Diamond Viper V330 video card to use its own drivers. NT uses the standard VGA driver and works only at 800x600 maximum. I've sent back the card and got a new one, but still have the same problem. I contacted Diamond, and they said I needed a new BIOS that supports disabling video BIOS shadowing and caching? Is this true, what do these terms mean, and how do I get a new BIOS?

Dean Kilbourn

Hardware editor Andrew Sanchez replies: *Shadowing refers to the BIOS's ability to copy the contents of a video card BIOS ROM (stored in slower EPROM) into faster RAM for greater performance. Also, ROM's limited to 8- or 16-bit wide access, while RAM has 32-bit wide access. You can make this process even faster by caching it. In order to get a new motherboard BIOS, you'll need to go to your motherboard maker's respected web site and download the latest AMI BIOS for your specific motherboard. You can also try going to AMI's own web site at www.amibios.com and take a look to see if anything you need is there. You should really start at your motherboard manufacturer's site first.*

EACH MONTH, **BOOT** EDITORS GATHER THE **BEST** PRODUCTS IN A SPECIFIC **CATEGORY** AND DEEM THEM: **BOOTWORTHY**

PC CA

People on the go need reliable equipment, so we pulled together the ultimate collection of PC cards, covering the necessities of notebook life. We ran these babies through the gamut of tests. Using these cards solo or in union, you'll be able to photograph and send pictures off via internet or remote connectivity, plug into a network configured for any speed or topography, and hook up removable drives such as Jaz and Zip, hard drives, or even CD-Rs.

Notebooks today rival their desktop siblings, and these new peripherals are actually stepping beyond the power of desktop peripherals. PC cards that utilize hot-swappable features can be yanked out and inserted with ease; try doing that with a PCI card (no, don't). Mobility is truly developing into a viable alternative to the chained-down world, and all we can say is "It's about damn time!"

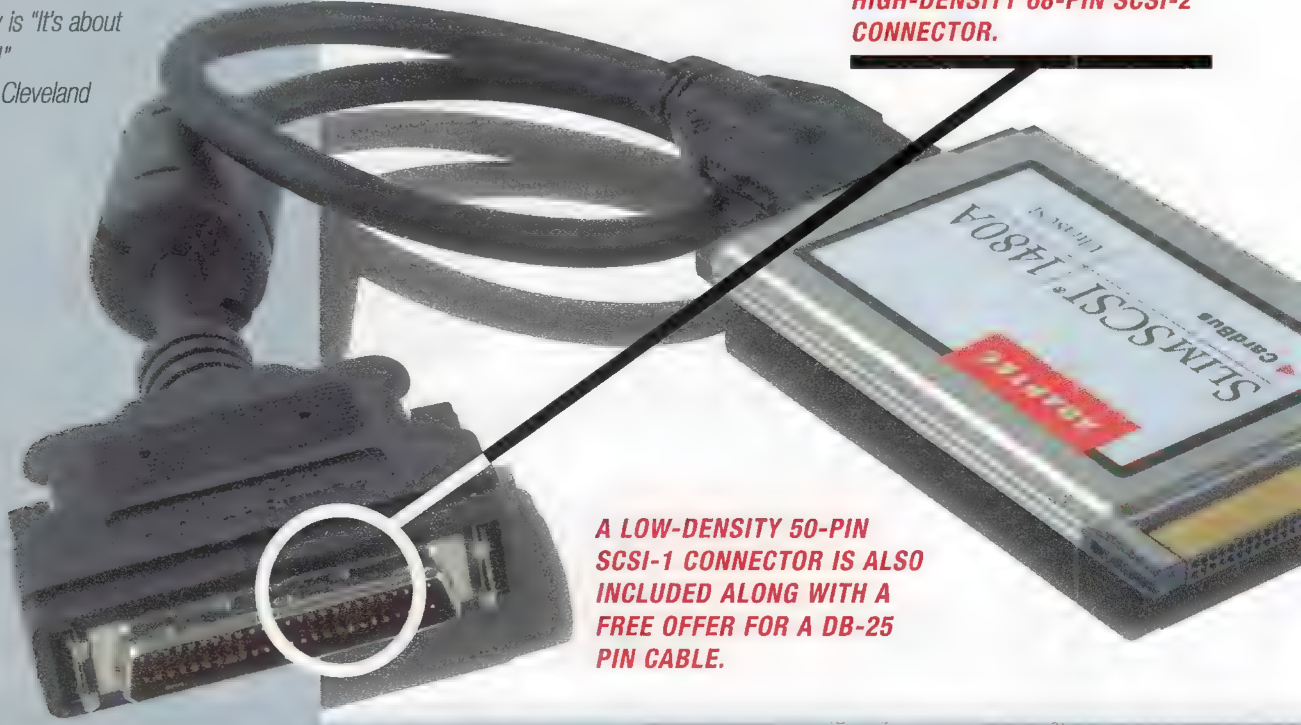
—Sean Cleveland

Adaptec *SlimSCSI 1480*

Impressive is the word for Adaptec's new SlimSCSI 1480 Type II PC card. Finally, a PC card that adds Ultra SCSI support for connection of high-performance drives. The 1480 can connect up to three SCSI devices with a combined distance of up to 1.5 meters and deliver full 32-bit performance. The maximum transfer rate is 20MB/sec across the SCSI card bus, allowing your notebook to finally utilize the blazing performance of Ultra SCSI hard drives. And yes, it is all hot swappable. You simply attach your devices, put the 1480 into your notebook where it is instantly recognized, and add the drivers when prompted, and you're ready to rock-n-roll. Included is Adaptec's legendary *EasySCSI 4.0* with all the utilities you'll ever need for diagnosing, burning disks, and backing up critical files. Device support is anything SCSI, meaning you can finally attach all those devices that are lacking on the notebook side, such as Jaz, Zip, Syquest, CD-R, and DVD drives. Adaptec claims the performance of a Jaz drive is increased by 173% with the 1480. Now that rocks!

product info

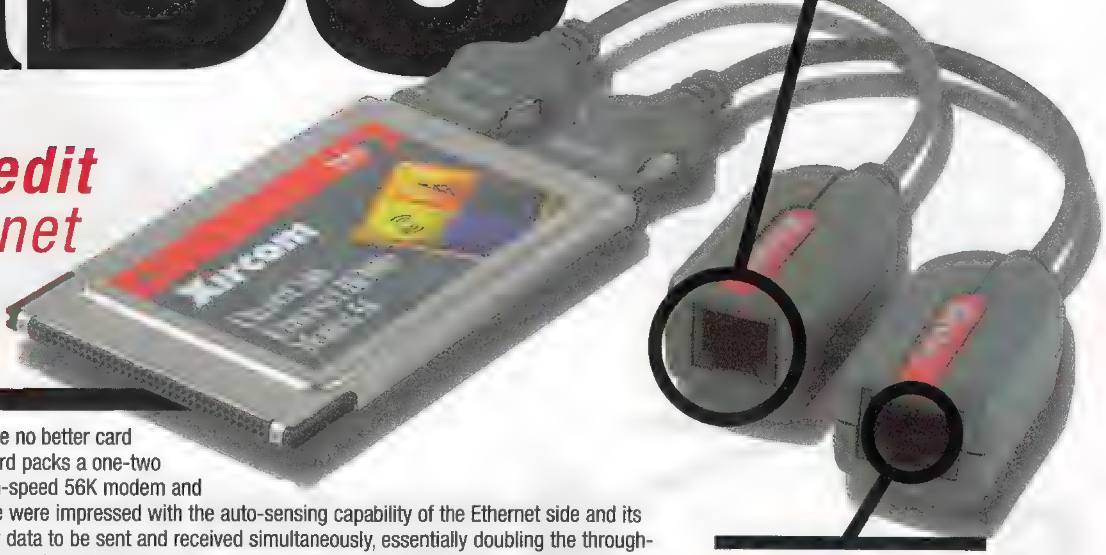
Price $239
Company Adaptec
Phone 800.442.7274
URL www.adaptec.com



HIGH-DENSITY 68-PIN SCSI-2 CONNECTOR.

A LOW-DENSITY 50-PIN SCSI-1 CONNECTOR IS ALSO INCLUDED ALONG WITH A FREE OFFER FOR A DB-25 PIN CABLE.

ARDS



STANDARD RJ-11 TELEPHONE CABLE CONNECTOR CONNECTS TO A PHONE LINE.

RJ-45 TWISTED PAIR ETHERNET CONNECTOR.

Xircom Credit Card Ethernet 10/100+ Modem 56

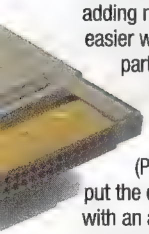
For those needing it all, there can be no better card than the Xircom CreditCard. This card packs a one-two punch, with inclusion of both a high-speed 56K modem and 10/100Mb/sec Ethernet adapter. We were impressed with the auto-sensing capability of the Ethernet side and its full-duplex capabilities, which allow data to be sent and received simultaneously, essentially doubling the throughput, but on 10Mb/sec, full-duplex networks only. Advanced Look-Ahead Pipelining is also supported. The card itself contains a flash ROM for easy upgradability. The modem side uses K56flex technology and pumps information smoothly and hassle-free, and offers Xircom's Data Shield, which protects the modem from high-current digital phone lines. Xircom also offers a Cellular Connection Kit for AMPS cellular phones in the United States and Canada, and a GSM Connection Kit for a truly wireless experience. Faxing has a speed limit of 14,400, though. The Xircom CreditCard is a Type II PC card that supports hot swapping and full suspend/resume power management.

product info

Price $379
Company Xircom
Phone 800.438.4526
URL www.xircom.com

THE BEEFY CALLUNACARD TAKES UP TWO TYPE III SLOTS.

Callunacard 520MB Hard Drive



Notebook manufacturers are notorious for including inadequate hard drives. A measly gig or two doesn't cut it for processors powerful enough for high-end space-hoggin' apps. And adding new drives is a royal pain. Well, with the Callunacard CT520M, there's no faster or easier way to add disk space to your laptop. This Type III PC card requires no third-party drivers and uses the standard IDE/ESDI hard disk controller that comes with Windows. You simply pop it in, format it to your specs, and use it. The drive's two disks and four heads utilize the latest Magneto Resistive (MR) head technology along with Partial Response Maximum Likelihood (PRML) read channel techniques. Adaptec's Threadmark put the data transfer rate under heavy stress at 1.01MB/sec with an average CPU utilization of 52%—not bad for a first-generation PC card hard drive. The average seek time is 12ms with an average latency of 6.25ms. A straight read from the drive is in the ballpark, though averaging 3.76MB/sec to 6MB/sec. Expect to see a 1.4GB version soon, with a 520MB Type II version to arrive sometime in the third quarter.

product info

Price $599
Company Calluna
Phone 800.453.4753
URL www.calluna1.com

Multi-Tech MultiMobile 10/100 **Ethernet Card**

GREEN LINK-INTEGRITY LIGHT FOR DIAGNOSING LINE CONNECTION.
LIGHT IS ON DURING 100Mb/sec OPERATION AND OFF DURING 10Mb/sec.
FULL DUPLEX MEANS DATA CAN BE SENT AND RECEIVED AT THE SAME TIME.
MultiMobile
Ethernet
10/100 Mb

The Multi-Tech MultiMobile is a down-and-dirty PC card that compromises nothing getting to the point. And that point is simple Ethernet connectivity. This was the card we grabbed first, and it survived two weeks in the bootLab being hit with all we had. Offering tools and support for Novell, MS LAN Manager, all flavors of Windows, OS/2 Warp version 3, NDIS2 and ODI drivers for Workgroups, Lotus Notes drivers, and Artisoft Lantastic, it's the card for the truly networked insane! And yes, it is NE2000 compatible. Full-duplex capabilities for both 10Mb/sec and 100Mb/sec speeds, allowing data to be sent and received simultaneously and auto-negotiation between all four operation modes, make this a truly powerful companion. It's a Type II PC card with full PnP compliance and hot-swapping capabilities.

product info

Price $229
Company Multi-Tech Systems
Phone 800.328.9717
URL www.multitech.com

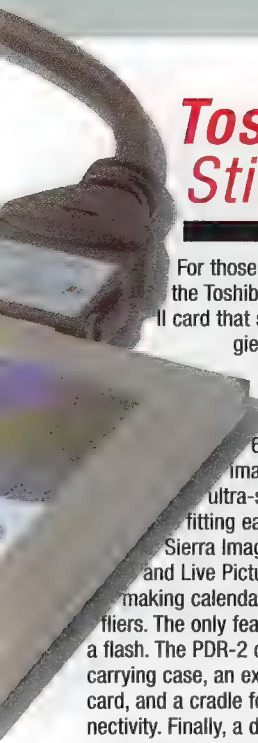
BreezeCOM BreezeNET PRO Wireless **Ethernet Card**

TWO INTEGRATED ANTENNAS ARE DYNAMICALLY SELECTED FOR IMPROVED PERFORMANCE.
AP-10 PRO CONNECTS TO ANY 10Mb ETHERNET LAN.
SA-PC PRO PC CARD ADAPTER OFFERS A TRULY WIRELESS CONNECTION.

Not something you would take on the road (unless you have a hub in your car), but certainly something that would allow you to take your notebook around the office is BreezeCOM's BreezeNet PRO wireless Ethernet PC card. Meeting specifications of the IEEE 802.11 wireless LAN standard, it offers wireless connectivity at distances of up to 3,000 feet and speeds of 3Mb/sec. The SA-PC wireless PC card side is PnP and requires little configuration. The AP-10 PRO Access Point, the actual unit that connects to the network backbone, may require a little tweaking, although it's simple using the diagnostic cable that connects to a standard comm port. It uses spread-spectrum radio technology and operates in the license-free 2.4GHz industrial, scientific, and medical (ISM) band. An innovative, fast-roaming mechanism guarantees network connectivity even when roaming at speeds of up to 60mph! The Access Point connects to any 10Mb/sec 10BaseT network and works with Win95, WinNT, and Novell networks. The PC card is Type II and offers hot swapping functionality.

product info

Price $1495 for Access Point; $565 for the PC Card
Company BreezeCOM
Phone 760.431.9880
URL www.breezecom.com

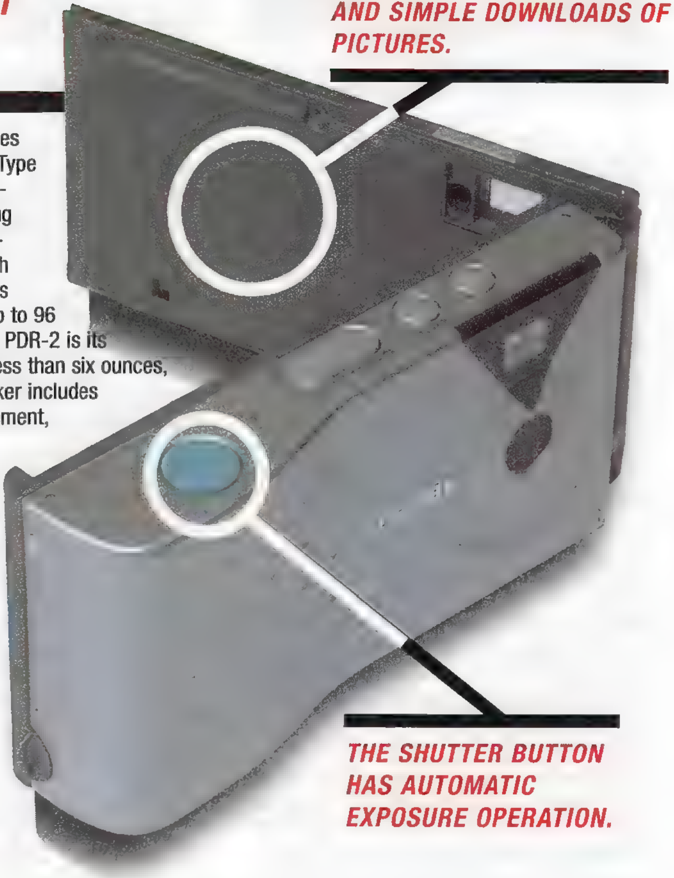


Toshiba PDR-2 Digital Still **Camera**

For those seeking a truly wireless way to capture the moment comes the Toshiba PDR-2 digital PC card camera. Unique to it is a built-in Type II card that slides into your notebook for fast and convenient PnP boogieing. Fully hot-swappable, it makes taking and downloading pictures a drag-and-drop affair. It incorporates a stamp-sized SSFDC SmartMedia removable 2MB flash card with a storage capacity of 48 low-res images and 22 high-res 640x480 24-bit color images. A 4MB card that can hold up to 96 images is expected this summer. The coolest thing about the PDR-2 is its ultra-slim footprint, as it measures 4⅛x2⅛ inches and weighs less than six ounces, fitting easily into a shirt pocket. Software backing this power-packer includes Sierra Imaging's *Image Expert* for image editing and picture management, and Live Picture's *LivePix* for making calendars, cards, and fliers. The only feature lacking was a flash. The PDR-2 comes with a carrying case, an extra 2MB flash card, and a cradle for desktop connectivity. Finally, a digital camera small enough to actually keep handy whilst traveling light.

product info

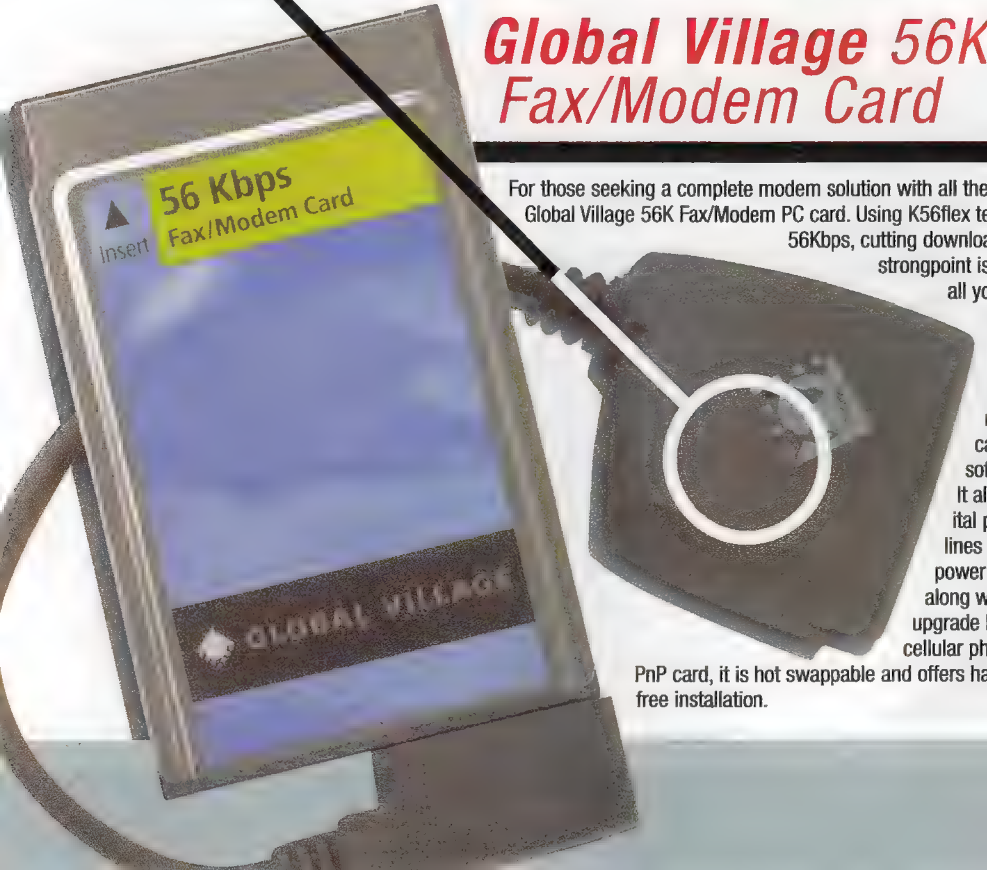
Price $399
Company Toshiba
Phone 714.455.2000
URL www.toshiba.com/taisisd



THIS PC CARD SLIDES INTO YOUR NOTEBOOK FOR FAST AND SIMPLE DOWNLOADS OF PICTURES.

THE SHUTTER BUTTON HAS AUTOMATIC EXPOSURE OPERATION.

TWO STANDARD RJ-11 TELEPHONE CABLE CONNECTORS GO TO A PHONE AND A LINE OUT.



Global Village 56K Fax/Modem Card

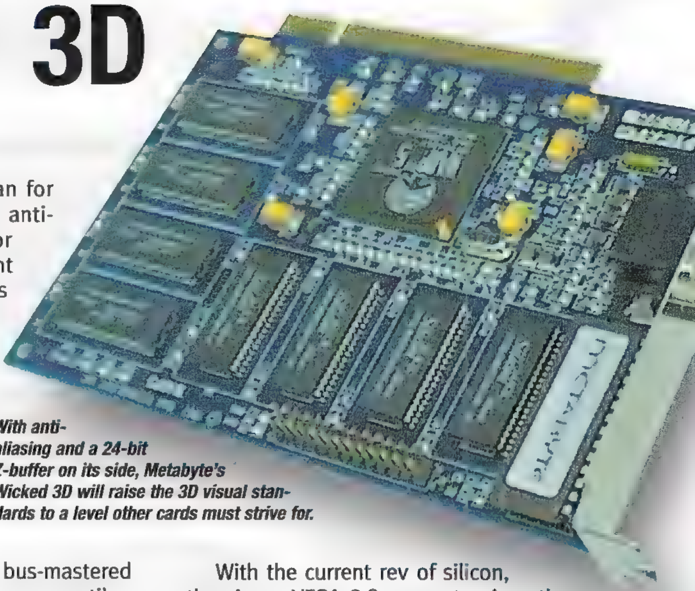
For those seeking a complete modem solution with all the bells and whistles, look no further than the Global Village 56K Fax/Modem PC card. Using K56flex technology, it allows for download speeds up to 56Kbps, cutting download and web access times dramatically. The strongpoint is in the software, though, and *FaxWorks* contains all you need to take advantage of smart dialing, faxing, and unified fax and data phone book features. If you're going to buy a modem card, it should be from a reputable company that recognizes the ever-evolving and changing world of modem standards. Global Village does. This card's flash ROM technology makes upgrading its software-based DSP to newer technologies a snap. It also contains special circuitry for high-current digital phone lines and power surges, along with an upgrade kit for cellular phones. A PnP card, it is hot swappable and offers hassle-free installation.

product info

Price $199
Company Global Village
Phone 800.736.4821
URL www.globalvillage.com

Metabyte Wicked 3D

Some anti-aliasing this way comes



With anti-aliasing and a 24-bit Z-buffer on its side, Metabyte's Wicked 3D will raise the 3D visual standards to a level other cards must strive for.

The next level of 3D acceleration is coming, and Metabyte's Wicked 3D is leading the way toward a smoother 3D-accelerated world, with full-screen, anti-aliased, texture-mapped polygons galore.

Wicked 3D is based on Oak Technology's WARP 5 (Windows Accelerator and Rendering Processor), a 64-bit 2D/3D graphics accelerator that tosses texels on-screen regionally, or tiled—very similar to the PowerVR's approach to 3D. Because of this tile-based renderer, Z-values and anti-aliasing data are stored on-chip at the sub-pixel level. With this hardware Z-buffer in place (via Oak's FreeZe memory-less hidden surface removal algorithm), local memory is freed up for texture storage. Memory bandwidth limitations are reduced as well, thanks to the on-chip texture cache. WARP 5 also performs 24-bit floating-point Z-buffering for higher depth precision and is optimized for trilinear, mip-mapped filtering. The integrated GrafixPump drawing engine takes care of all 2D duties, while the WARP 5 architecture can access up to 8MB of EDO DRAM, SDRAM, or SGRAM. PixelVu video scaling hardware promises 8-tap and 4-tap bilinear video interpolation and arbitrary scaling for video playback.

What does all this mean for you? It means full-screen, anti-aliased 3D acceleration for all your favorite apps right out of the box. So, games such as *Jedi Knight* or *Heavy Gear* get a smooth coating of softened, anti-aliased pixels to ward away those nasty "jaggies." (See sidebar for a hands-on, head-to-head, *Heavy Gear* comparison)

The Wicked 3D is a PCI bus-mastered solution only, so no AGP for you until later. A 175MHz integrated triple 8-bit RAMDAC capable of delivering resolutions up to 1280x1024@65K color depth is linked to 4MB of nonupgradable EDO DRAM. As expected, all your favorite 3D features are present and accounted for, including Gouraud shading, nonlinear or per-pixel fogging, texture translucency, and polygon translucency, as well as the aforementioned bilinear and trilinear mip-mapped filtering. But, the WARP 5 may fall victim to the same performance pitfalls the PCX2 is currently trying to ward off, such as poor performance when software accesses the Z-buffer or mixing 2D and 3D rendering.

With the current rev of silicon, there's no VESA 2.0 support—since the BIOS is nonflashable, Metabyte should fix this before shipping Wicked 3D. If not, there's always SciTech's *Display Doctor 6*.

As for APIs, DirectX, Direct3D, and ActiveMovie are present and accounted for. And Metabyte is currently evaluating OpenGL ICD implementation for *GLQuake*-ing, but so far hasn't officially announced plans.

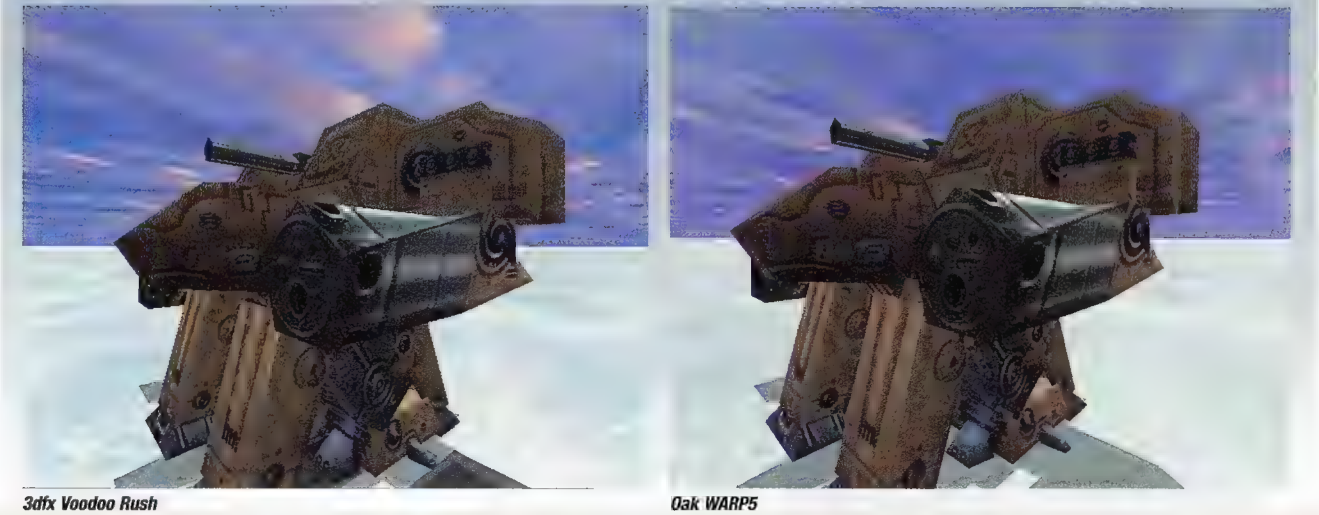
Metabyte also introduces Re2Flex, a new monitor refresh and resolution adjustment technology. Rather than rely on traditional methods of setting video modes, usually through INT 10h calls to the VGA BIOS, VESA, or Extended Display

The Difference is Real

If you doubt the power of sub-pixel anti-aliasing, take a peep at these two pictures from Activision's Heavy Gear.

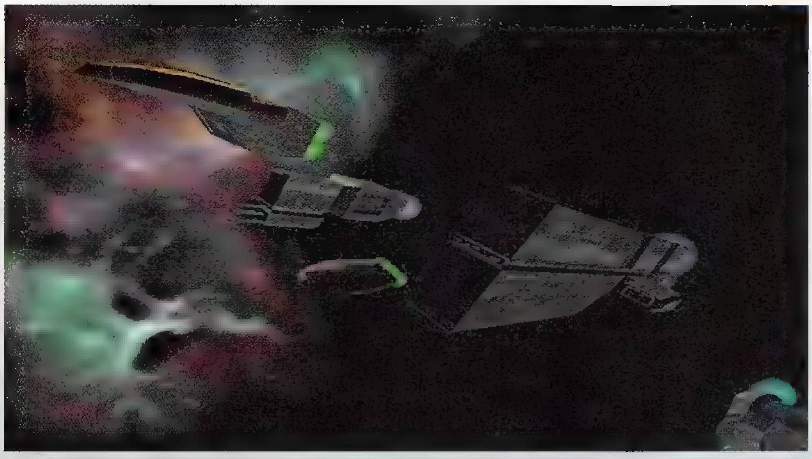
On the Voodoo Rush screenshot on the left, notice the jagged edges on all the Gear's angles. On the right is Wicked 3D. Notice the smooth edges and overall better visual fidelity. With Wicked 3D, this comes part and parcel with all D3D-accelerated games.

Nintendo 64, eat your heart out.



3dfx Voodoo Rush

Oak WARP5



Dare to Compare

Benchmark	Metabyte Wicked 3D*	Hercules Stingray	Videologic Apocalypse 5D
MDK PerfTest	94	94	94
X (640x480)	35.61fps	44.6fps	30.35fps
X (800x600)	25.92fps	40.1fps	25.56fps
Final Reality			
Overall	2.02 R-Marks	2.35 R-marks	1.80 R-Marks
2D	2.07 R-Marks	2.07 R-marks	2.08 R-Marks
Bus Speed	1.53 R-Marks	1.46 R-marks	1.61 R-Marks
3D	2.12 R-Marks	2.74 R-marks	1.71 R-Marks
Polygons	48.33Kpoly/sec	73.02Kpoly/sec	59.77Kpoly/sec
Fill	18.03Mpixels/sec	27.97Mpixels/sec	21.45Mpixels/sec
Robots	18.67fps	26.17fps	18.59fps
City	19.62fps	26.77fps	18.21fps

Notes: ** The Wicked 3D scores were taken with early rev silicon and beta drivers, not final shipping product. They are here to give you an idea how the technology is shaping up and how it compares to current tile-based technology. Also, bear in mind that the Wicked 3D is doing this all with sub-pixel anti-aliasing enabled. Results for* Final Reality *tests are taken at 640x480.*

Test Methodology *Micron Millennium Mxe, CPU: Intel Pentium 200MMX, RAM: 32MB EDO-DRAM, OS: Windows 95 OSR2 Build 1212*

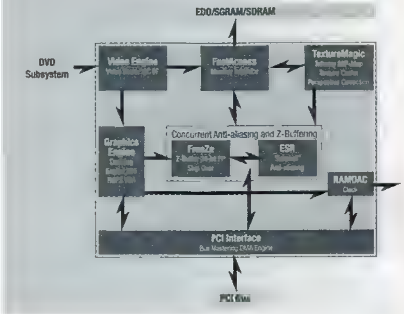
Identification Data (EDID), Re2Flex uses an algorithmic approach. This lets users tune in exact refresh rates (accurate to 1Hz granularity) and resolution (1 pixel vertical and 8 pixels horizontal) via Re2Flex. While this software wasn't present with this early beta build, Oak's drivers allowed texture compression adjustment, gamma correction, and more.

As the performance chart shows, with early beta drivers in place, the Wicked 3D keeps pace with the PowerVR PCX2's rendering power. While 2D performance kept in time with offerings from nVidia, *Jedi Knight* frame rates varied from 20fps to 30fps at 640x480, to 30fps to 60fps at 512x384. The WARP 5 is very scalable, so Pentium II 300 users can expect even faster frame rates at a given resolution. Visual quality is on par with 3Dfx's Voodoo.

Until final product starts shipping, we'll have to wait and see how much more power Metabyte can squeeze out of the silicon. But if the Wicked 3D's visual performance is any indication of where PC 3D is heading, we're waiting with open arms to receive some full-screen, anti-aliased lovin'.

—Andrew Sanchez

This block diagram showcases what powers the Wicked 3D. WARP 5 handles all processing, such as concurrent anti-aliasing and Z-buffer processing, texture-caching, and video scalar, onto the processor. Bringing the Z-buffer processing onto the chip frees up local video memory for more textures, while TextureMagic gives you trilinear mip-mapping and more.



product info

Available Q1 1997
Price $139
Company Metabyte
Phone 510.494.9700
URL www.metabyte.com

HARDWARE ON THE HORIZON AND SOFTWARE SOON TO SHIP

Metabyte Wicked 3D 66
Tonic Trouble 68
Falcon 4.0 69

The boot Tracking Sheet

TITLE	DEVELOPER	DATE
Forsaken	Acclaim	Feb-98
Rebellion	LucasArts	Feb-98
Populous: The Third Coming	Bullfrog/EA	Feb-98
Formula 1 Championship Edition	Psygnosis	Feb-98
Star Trek: First Contact	Microprose	Feb-98
F22 Air Dominance Fighter	DID/Ocean Intl	Feb-98
Extreme Tactics	Media Station	Feb-98
Monster 3D 2	**Diamond Multimedia**	**Mar-98**
Renegade 3D	**Jazz Multimedia**	**Mar-98**
3D Blaster Voodoo 2	**Creative Labs**	**Mar-98**
AMD K6 266MHz	**AMD**	**Mar-98**
Intel Pentium II 333MHz Slot 1	**Intel**	**Mar-98**
Apollo VP3 PCIset 100MHz/AGP	**VIA Technologies**	**Mar-98**
Baldur's Gate	Bioware/Interplay	Mar-98
Unreal	Digital Extremes GT Interactive	Mar-98
Powerboat Racing	VR Sports	Mar-98
SiN	Ritual/Activision	Mar-98
Dark Vengeance	Reality Bytes	Mar-98
Daikatana	Ion Storm/Eidos	Mar-98
Interstate '76 Nitro Pack	Activision	Mar-98
Adrenix	Digital Dialect/[illegible]	Mar-98
Outwars	Microsoft	Mar-98
AMD K6 300MHz	**AMD**	**Apr-98**
AMD AMD-640 100MHz/AGP PCIset	**AMD**	**Apr-98**
Half-Life	Sierra Studios	Apr-98
Battlezone	Activision	Apr-98
Falcon 4.0	Microprose	Apr-98
Red Line Racer	Criterion/Ubi Soft	Apr-98
Trespasser	DreamWorks	Apr-98
Baseball 3D	Microsoft	Apr-98
The Dark Project	Looking Glass Technologies	Apr-98
Anarchy	Microsoft	Apr-98
F22 Total Air War	DID/Ocean Intl	Apr-98
Ultimate Race Pro	Kalisto/Microprose	Apr-98
Redline	Beyond Games/Accolade	Apr-98
Deschutes/Slot 2	Intel	Q3/98
Mobile Deschutes	Intel	Q3/98
K6+3D 400MHz	AMD	Q4/98
Starship Troopers	Microprose	Q2/98
Requiem	3DO/Cyclone Studios	Q2/98
Extreme Warfare	Trilobyte/Red Orb	Q2/98
Grand Prix Legends	Papyrus/Sierra Online	Q2/98
Kings Quest: Mask of Eternity	Sierra	Q2/98
Reno Air Racing	Papyrus/Sierra Online	Q2/98
MechCommander	Microprose	Q2/98
The Dark Project	Eidos/Looking Glass	Q2/98
[illegible]	Microsoft	Q2/98
Grim Fandango	LucasArts	Q2/98
Dark Vengeance	Reality Bytes	Q2/98
Descent: Free Space	Interplay/Volition	Q2/98
10th Planet	Bethesda	Q3/98
Messiah	Shiny/Interplay	Q3/98
Windows 98/Memphis	Microsoft	Q3/98
Duke Nukem Forever	3D Realms	Q3/98
Star Trek: Klingon Honor Guard	Microprose	Q3/98
Descent III	Interplay Outrage Entertainment	Q4/98
Prey	3D Realms	Q4/98
Starship Troopers	Microprose	Q4/98
Windows NT 5.0	Microsoft	Q4/98

*These dates are subject to change
**Bold indicates hardware

Tonic Trouble

Bundle of joy

Shrouded in mystery, the Intel 740 is a 2D/3D solution that promises to pose a serious challenge to the Voodoo 2s of the world. While we can't divulge the details of the new AGP part for fear of waking up to corporate sponsored assassins, we asked ***Gregoire Gobbi****, Worldwide Project Manager for* Tonic Trouble*, to shed some light on the game that'll come bundled with the Intel 740.*

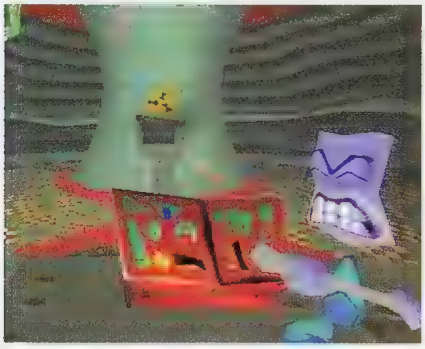
With AGP, DVD, LOD, and ACP, Tonic Trouble *has more technological advancements than you can shake a stick at.*

boot Can the characters interact with the environment in Tonic Trouble?

Gobbi Ubi Soft's new 3D-integration engine allows interactivity and freedom of movement beyond anything seen before in gaming. Gamers can go absolutely anywhere in an environment. Each of the ten environment maps has a very specific atmosphere built around it. The backgrounds contain secret passages, and sometimes the player must explode obstacles or make some part of the background move to go forward.

boot What are you doing to get more realistic movements and behaviors out of the characters?

Gobbi The game was built with a proprietary 3D integration tool and modular, scalable engine developed by 50 Ubi Soft developers over an 18-month period at a cost of $4 million. The Architecture Commune Programmation (ACP) puts creative control in the hands of the game designers rather than the programming team. The result is more complex characters, graphic environments, and problem-solving challenges. Characters change behavior and expressions; game settings are richer; gameplay becomes more interactive.



Tonic Trouble *contains approximately 40 characters that take on a life of their own, appearing and reappearing throughout the game depending on the player's actions.*

In a game such as *Mario 64*, characters other than Mario are one-dimensional behaviorally. In *Tonic Trouble*, all characters react differently at different times. Other characters may chase, run away, jump, or scare, according to the situation.

boot What can we expect in terms of enemy AI?

Gobbi Every element of the game (backgrounds, textures, objects, characters, environments) can be given an AI. In the past, the level designers received the standard characters made by the engineers and placed them in the level. The AI made by the engineers limited their freedom and creativity. *Tonic* works in a different way: For each character, the designer gets a kit of animation (around 40 animations per character) and builds the character's AI with a simple language. This leads to much more variety in the behavior of characters and objects.

boot What does AGP do for Tonic?

Gobbi We get better performance and can deliver more polygons to the player. This means smooth 3D modeling (vs. square rooms), more interactive characters, better immersion, and more fun. AGP lets you load the textures in central RAM, so we're no longer limited by the 2MB or 4MB VRAM of the card but by the RAM of the PC, which is easily scalable and relatively inexpensive. In *Tonic*, we have up to 12MB of texture memory for richer graphics.

While it has been specifically designed for AGP, Tonic Trouble *will also scale down its level of detail to other 3D cards.*

boot Which card shows off Tonic Trouble the best?

Gobbi *Tonic* is optimized and specially designed for 3Dfx, nVidia Riva 128C, and ATI Rage Pro and Intel 740, both AGP supported cards. Additionally, the game is compatible with any card supporting D3D.

At the moment, the card on which we have the best result is the Intel 740. We've seen around 200,000 poly/sec and 1024x1024 texture maps all running at 32-bit color.

boot What have you done to keep up frame rates?

Gobbi We've managed different levels of detail on our 3D objects, with texture mip-mapping. We've spent two months on optimizations (assembly code and memory optimizations). We're shooting for 30fps on a "good" 2x AGP card.

boot What audio advances does Tonic Trouble offer?

Gobbi Typically, games have several tracks that repeat over and over, and the music changes are based only on the player's place in the game. *Tonic* offers 12 long tracks, and the music changes to reflect the character's response to the action. In addition to these features, *Tonic* utilizes Dolby sound to further the game's "total immersion" process. The DVD version will be encoded with 5.1 channel 3D Dolby digital (AC-3) sound.

product info

Available ***April 1998***
Price ***TBA***
Company ***Ubi Soft***
Phone ***800.824.7638***
URL ***www.ubisoft.com***

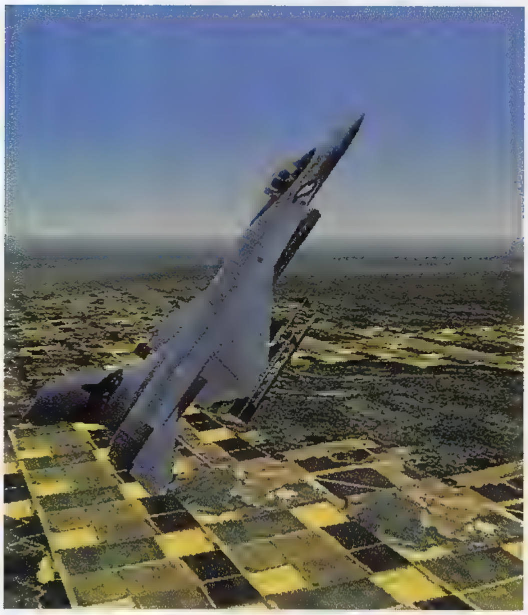
Falcon 4.0

TRY IT ON THE DISC

Recommissioned

With its introduction in 1991, Falcon 3.0 *assumed a position as one of the most realistic, graphically detailed flight sims of the pre-3D-accelerated gaming world. It was the first sim to let you command a squadron of fighters in a campaign atmosphere, and its networked battlefields introduced the possibility of multi-player aerial warfare.* Falcon 4.0 *promises to take the flight model to new levels both graphically and mechanically, and achieve the dynamic online aerial warfare only hinted at in* Falcon 3.0.

We talked with **Leon Rosenshein**, *the game's producer, to find out how much right stuff made it into* Falcon 4.0.



Featuring an impressive terrain data set, Falcon 4.0 *achieves its beautifully detailed horizons by intelligently scaling back the polygon count on distant terrain.*

boot* *What sort of campaigns will* Falcon 4.0 *feature? Who are your enemies, and what's the arena of operations?

Rosenshein *Falcon 4.0* will be set in the Korean peninsula. Players work with the South Koreans defending against the North, sometimes aided by China and/or Russia.

boot Besides the F-16, what planes will players be able to fly?

Rosenshein Players will only be able to fly the latest version of the F-16C, the Block 50. We will follow up *Falcon 4.0* with a MiG-29 adversary game. Additional aircraft products in this family are also under investigation.

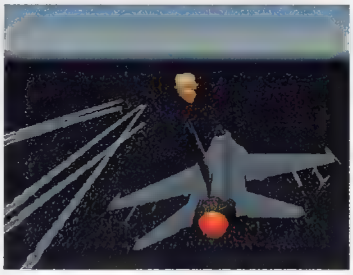
boot What sort of flight model are you working toward?

Rosenshein *Falcon 4.0* uses an entirely new six-degree-of-freedom flight model that uses actual flight-test data as well as Air Force requirement documents to create the most realistic F-16 model available. It has been verified by active F-16 pilots.

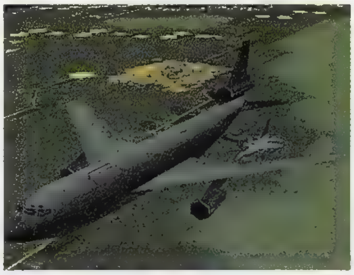
We'll provide both an ultra-realistic flight model for hardcore gamers and a simplified model for more casual players. Both options are much more on the realistic side than the arcade side.

boot Tell us about the terrain generator in development for* Falcon *4.0?

Rosenshein It's a brand-new, fully texture-mapped polygon engine. Terrain texture resolution can go down to four meters per pixel throughout the theater. Textures are derived from aerial photography, since satellite data doesn't have enough resolution. Terrain elevation is from satellite data with data every 250 meters.



Falcon*'s advanced avionics realistically model not only the F-16 but the air-to-air missiles ripping across its wing.*



Falcon 4.0 *is the first combat sim to support air-to-air refueling.*

boot How many polygons will the standard terrain map have?

Rosenshein The terrain data set is approximately 1000km by 700km. The grand total is 2.5 million triangles. Obviously, they're not all drawn at once, but at any given time about 2,000 polygons are on-screen.

boot What have you done to push the horizon further out?

Rosenshein The obvious first step is to create a very efficient engine that can handle lots of polygons. We've also implemented a sophisticated level-of-detail system that reduces the cost of drawing very distant terrain without sacrificing visual quality.

boot Do you plan on using 3D acceleration? MMX? AGP?

Rosenshein We have 3D-hardware support in place. It's not clear how much special code, if any, we'll write specifically for AGP or MMX, but we do work with and achieve better performance on systems that incorporate those technologies.

boot Is 3D card support provided through Direct3D, or are you writing directly to any card APIs?

Rosenshein Both. We have a Glide driver for 3Dfx, a direct-to-hardware driver for Permedia 2, a custom software driver written in-house, and a D3D driver. We've found we get much better results when we have a custom driver, but can't invest the effort to do custom drivers for all the cards, so we fall back to D3D.

boot How much freedom is there to fly around the map area?

Rosenshein The player can fly through the entire database, although you will need to accomplish aerial refueling to fly that distance. When flying in Instant Action you can choose to fly anywhere in the theater, while in Campaign you can choose which airbase you fly out of.

boot How realistic is the cockpit?

Rosenshein The cockpit is a 3D model, after the actual F-16 cockpit. The cockpit has lights, dials, gauges, MFDs, and buttons working in the static cockpit views, and lights, dials, and MFDs working in the virtual cockpit.

boot Will there be multiplayer support?

Rosenshein *Falcon 4.0* was designed from the start as a multiplayer game. All portions of the game except Instant Action are multiplayer. Dogfight provides for deathmatch and team multiplayer, Campaign mode provides for cooperative multiplayer, and Tactical Engagement (mission builder) lets the player define his own single- or multiplayer mission.

product info

Available ***April 1998***
Price ***TBA***
Company ***Microprose***
Phone ***800.695.4263***
URL ***www.microprose.com***

REVIEWS

KICKIN' THE TIRES ON THE LATEST **HARDWARE** AND TAKIN' THE NEWEST **SOFTWARE** OUT FOR A SPIN

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New bootLab Policy

Revised Benchmarks

boot *isn't like any other computer magazine, and neither is our product-**evaluation** process. We don't test equipment in the cold, sterile environment of a warehouse-size lab, and we don't write our reviews based on the **test scores** that labcoat-wearing technicians scribble on clipboards.*

*Our review **scores** are based on a combination of objective **benchmark** testing, real-world performance, and our subjective evaluation of features, performance, and the many less tangible **characteristics** that go into a product. All of our evaluations are based on **hands-on** use of the product.*

This month *boot* overhauls its benchmarks, and with faster processors, 3D accelerators, and media drives hitting the bootLab, the new scoring system couldn't have come at a better time. All benchmark scales are higher across the board. For example, the high-end for our basic bootMark is now 175, up from 150. The increase reflects the current performance of 333MHz Pentium IIs (see next month's cover story) and projects how Slot II Deschutes CPUs should perform when they arrive later this year. We expect the current performance scales to remain valid through 1998.

Acclaim's first-person shooter* Forsaken *has been turned into a* boot *benchmark—the ForsakenMark. Alpha-blending, colored lighting effects, and polygons galore will make any Direct3D-compliant card squeal for mercy. Only the best survive.

We've also changed two benchmarks entirely. To gauge Direct3D performance, we now use the ForsakenMark based on the upcoming sci-fi shooter *Forsaken*. Built by Acclaim expressly for *boot*, the ForsakenMark provides a stunning visual benchmark for alpha-blending, lighting effects, and filtering. And unlike Terramark, our old Direct3D benchmark, ForsakenMark reports average frames per second, a criterion that all gamers can easily relate to. Good accelerators will give you 60fps, the rate demanded by arcade machines and the acceptable standard for PCs in 1998. The magic number is 90fps for chart-busting performance. If you think this frame rate is too high, you haven't seen the muscle of Voodoo 2.

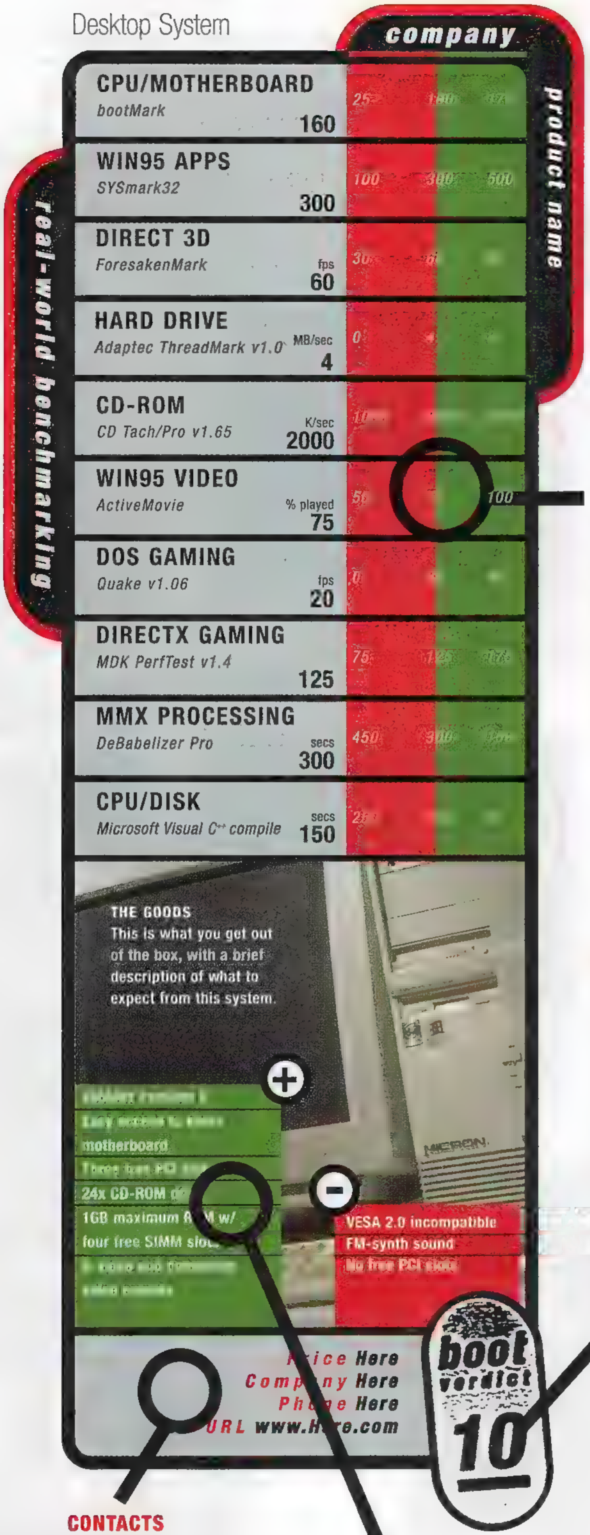
To test full-motion video, we've ditched the Video For Windows codec for ActiveMovie, the codec you'll most likely encounter during gameplay and in multimedia titles. We expect bootWorthy video cards to play 100% of all frames in our test file.

Only the **best** earn enough respect to be worthy of our **editors'-choice** award.

Testing your System at Home

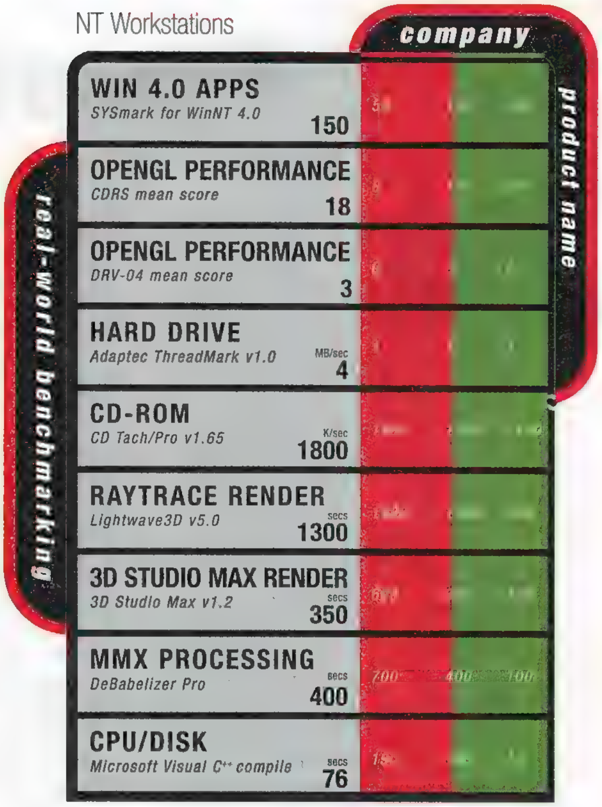
boot puts as many of its benchmarks on the bootDisc as possible. We encourage you to test your own machine, but advise you that our revised benchmark scales reach toward the pinnacle of Pure PC Power: superfast CPUs partnered with screaming components straight from fab. So if you benchmark your computer and find it can't muster a single green on the boot *scale, don't freak out. A P200 MMX fitted with a 3Dfx card is still a worthy machine, and if you're satisfied with your performance, that's all that really matters. Rest assured, power users,* boot *will continue to celebrate the fastest components available to keep you informed and dreaming of perfection.*

Desktop System


company
product name
real-world benchmarking
25
180
100
300
500
30
0
10
50
100
0
75
125
450
300
THE GOODS
This is what you get out of the box, with a brief description of what to expect from this system.
+
motherboard
24x CD-ROM d
1GB maximum R M w/
four free SIMM slo
−
VESA 2.0 incompatible
FM-synth sound
MICRON
P ice Here
Comp ny Here
Ph e Here
URL www.H e.com
boot verdict
10

CPU/MOTHERBOARD *bootMark*		160
WIN95 APPS *SYSmark32*		300
DIRECT 3D *ForesakenMark*	fps	60
HARD DRIVE *Adaptec ThreadMark v1.0*	MB/sec	4
CD-ROM *CD Tach/Pro v1.65*	K/sec	2000
WIN95 VIDEO *ActiveMovie*	% played	75
DOS GAMING *Quake v1.06*	fps	20
DIRECTX GAMING *MDK PerfTest v1.4*		125
MMX PROCESSING *DeBabelizer Pro*	secs	300
CPU/DISK *Microsoft Visual C++ compile*	secs	150

NT Workstations


company
product name
real-world benchmarking
700
400
100

WIN 4.0 APPS *SYSmark for WinNT 4.0*		150
OPENGL PERFORMANCE *CDRS mean score*		18
OPENGL PERFORMANCE *DRV-04 mean score*		3
HARD DRIVE *Adaptec ThreadMark v1.0*	MB/sec	4
CD-ROM *CD Tach/Pro v1.65*	K/sec	1800
RAYTRACE RENDER *Lightwave3D v5.0*	secs	1300
3D STUDIO MAX RENDER *3D Studio Max v1.2*	secs	350
MMX PROCESSING *DeBabelizer Pro*	secs	400
CPU/DISK *Microsoft Visual C++ compile*	secs	76

REAL-WORLD BENCHMARKING
The meter has the precise scores for each category benchmarked, and the color bars to the right give you a quick idea of how well the system performed in that category.

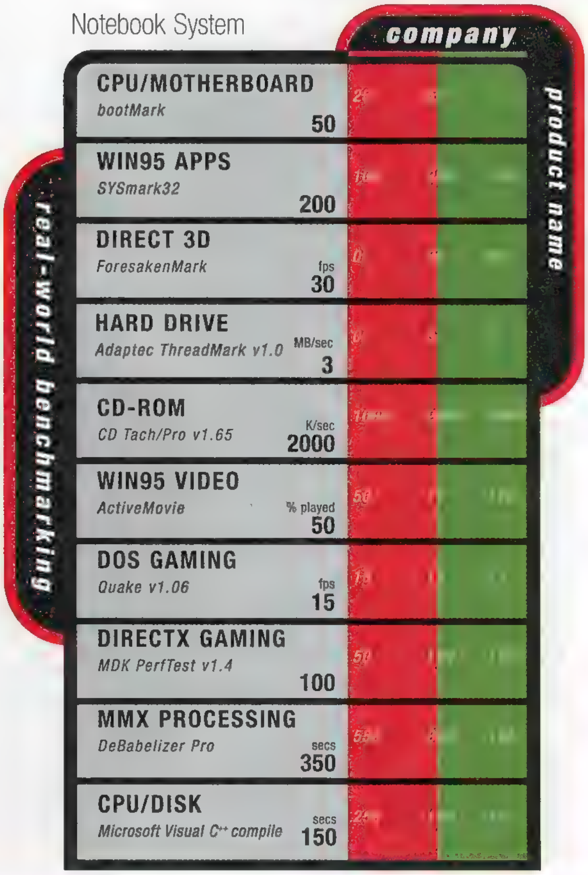
It's simple: The farther right the bar reaches, the better the system scored. Green means the system performed on par or beyond what we expect of a current system. If you see nothing but red, the system performed below expectations.

BOOT VERDICT
The one that really matters. This score reflects how we feel about a system, taking into account the benchmark results, quality of parts, usability, overall performance, and our intense, under-the-hood scrutiny.

CONTACTS
Look here for price, and the company's phone number and URL if you want more information.

PLUSES AND MINUSES
Here's where we list the best and worst a system has to offer.

Notebook System


company
product name
real-world benchmarking
50

CPU/MOTHERBOARD *bootMark*		50
WIN95 APPS *SYSmark32*		200
DIRECT 3D *ForesakenMark*	fps	30
HARD DRIVE *Adaptec ThreadMark v1.0*	MB/sec	3
CD-ROM *CD Tach/Pro v1.65*	K/sec	2000
WIN95 VIDEO *ActiveMovie*	% played	50
DOS GAMING *Quake v1.06*	fps	15
DIRECTX GAMING *MDK PerfTest v1.4*		100
MMX PROCESSING *DeBabelizer Pro*	secs	350
CPU/DISK *Microsoft Visual C++ compile*	secs	150

Micron **Powerdigm** XSU

NT rendering 4 U

After last month's purple 3D eater from Intergraph broke our benchmarks, can anything even compare? Micron thinks so, and the Powerdigm XSU is its answer for NT workstation maniacs striving to reach rendering nirvana.

The exterior tower case is standard Micron fare, but inside lurk two Pentium II 300MHz processors. Micron engineered twin-fan cooling for these bad boys, but only the CPU closest to the fans gets to feel the full cooling effects. Don't expect Intel's 440FX or 440LX chipset to drive these twin terrors. Instead, Micron opted for its proprietary Samurai core-logic PCIset (see sidebar for the complete 411). This ATX, Micron-made motherboard comes with one 64-bit PCI, two PCI, one ISA, and one shared PCI/ISA slot, bringing the total number of usable expansion slots to a measly five. While ATX can handle up to seven slots, the top two were sacrificed for placement of the second CPU's Voltage Regulator Module. Four DIMM sockets handle system RAM needs—two are currently filled with 64MB DIMMs. Sitting in that 64-bit PCI slot and powered by 3Dlab's Permedia 2 accelerator is an 8MB Diamond FireGL 1000 Pro (reviewed on page 82).

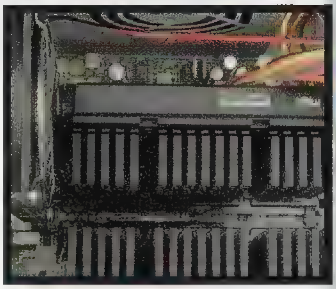
Under the Powerdigm's regime, EIDE is a no-show—instead, an Adaptec 2940UW PCI SCSI card acts as the storage media adapter. A Seagate ST3437W 4.3GB Ultra Wide SCSI is wired to the 16-bit Ultra Wide side, while Iomega's Jaz drive and Plextor's 12/20Plex PX20TS 20x CD-ROM drive sit on the 8-bit side. Despite the abundance of devices, the two free 3.5-inch and lone 5.25-inch bays guarantee there's still room to add even more stuff. Access to the Powerdigm's guts is easy thanks to the roomy tower case, while all the necessary power cables are already in place. Tunes and tones are handled by a combination of Creative Lab's AWE-64 ISA card and a pair of tiny Advent AV009 Powered Partners speakers, while display duties are handled by Hitachi's CM751 19-inch monitor.

Close scrutiny of the benchmarks reveals a solid machine, with results sitting the machine squarely in the green for every result. OpenGL performance was quick and about what you'd expect for a Permedia 2–based board—although fps is a far cry from the intense dive-bombing that Intergraph's TDZ-2000 delivered. Rendering times on both *Lightwave 3D* and *3D Studio Max* actually inched past the TDZ-2000 by a few seconds, as did Microsoft C++ compiles and MMX performance via our Debab Pro test.

The only knocks against this system are the 1024x768 true-color limitation of the video subsystem, while 64K color depth resolution maxes out at 1280x1024. The monitor also couldn't handle 1600x1200 at 60Hz, so ultra-high resolutions are out. Also, the lack of Ethernet connectivity hurts this workstation immensely. And while the Samurai grants access to 64-bit/66MHz PCI action, count out any AGP in your future.

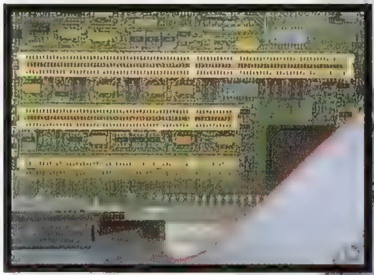
Lack of Ethernet connectivity aside, Micron's virgin foray into the breakneck NT workstation circuit is a solid contender. If Micron could re-engineer the motherboard layout so it could accommodate those two missing expansion slots, this machine would be that much stronger.

—Andrew Sanchez



DUELIN' CPUS

The top-most CPU gets cooled by both fans, while the other one's kinda outa luck.



SIZE DOES MATTER

With the FireGL 1000 Pro removed, you see the single 64-bit PCI slot lurking beside its smaller brothers.

THREE'S COMPANY

Why Micron decided not to use another fan for the lower processor will forever mystify us.

NO EIDE FOR YOU

SCSI is your interface of choice, and all your storage devices are pumpin' data through Adaptec's 2940UW PCI card. Very diggable.

under the hood

THE BRAINS

CPU	Dual Intel Pentium II 300MHz
L2 CACHE	512K SBRAM (internal)
RAM	128MB of SDRAM (1GB max)
Motherboard	Micron proprietary ATX mainboard with Micron Samurai PCIset

THE BRAWN

Video	Diamond FireGL 1000 Pro (3Dlabs' Permedia 2 with 8MB SGRAM)
Hard Drive	Seagate ST3437W Ultra Wide SCSI 4.3GB hard drive
CD-ROM	Plextor PX20TS 20x SCSI
Expansion Bus	One 64-bit PCI, two PCI, one ISA, one PCI/ISA shared
Fax/Modem	None
LAN	None
I/O Ports	Two USB, two serial, one parallel

THE BEAUTY

Display	Hitachi 19-inch CM751 .26 NI SVGA
Sound	Creative Labs AWE 64 Value ISA
Speakers	Advent AV009 Powered Partners
Other	Microsoft Intellimouse, Iomega Jaz drive

THE BUNDLE Windows NT 4.0

boot	*down*
1:53	:22

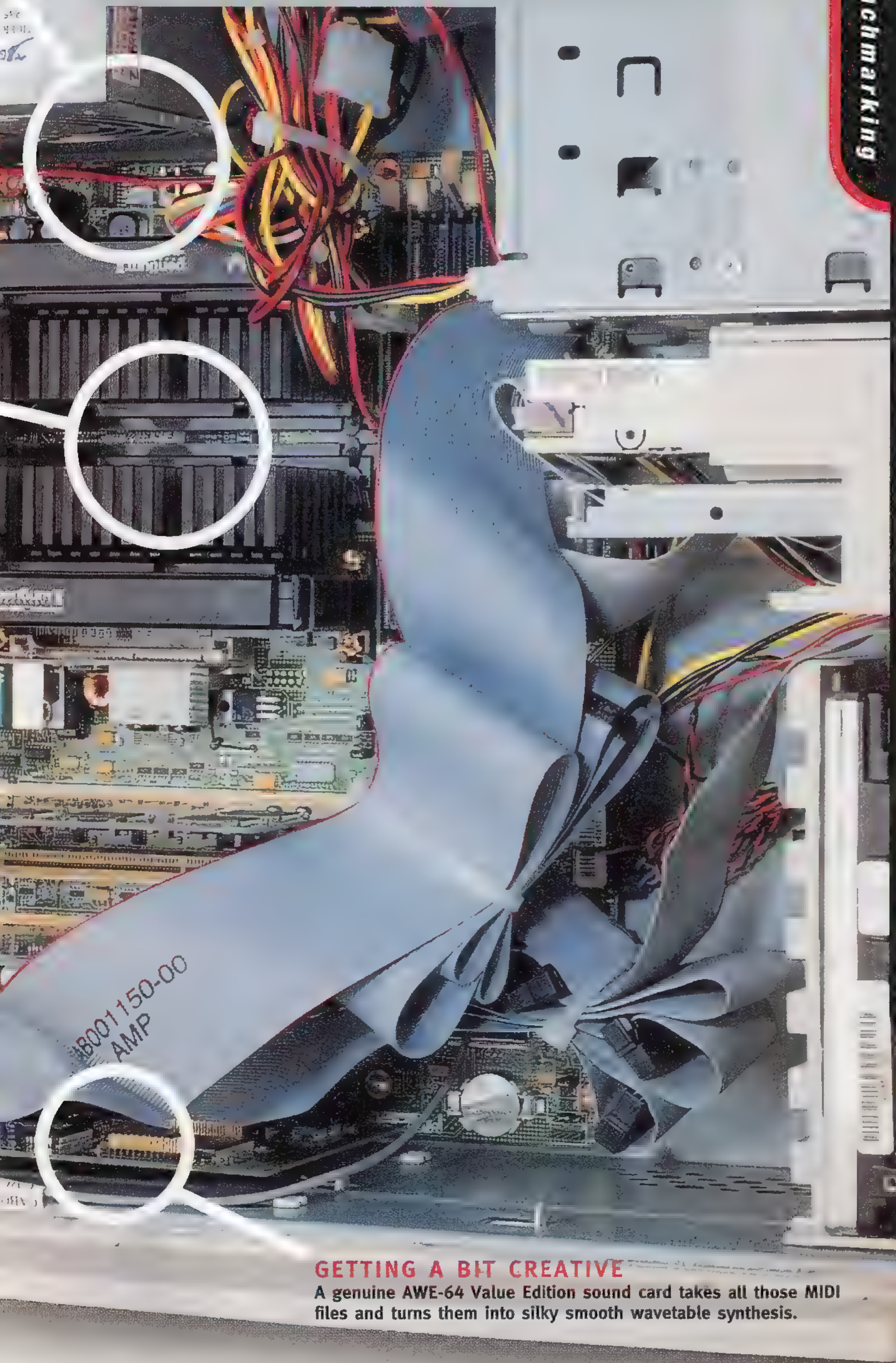
EXPANSION MAP

PCI	Video card
PCI	Free
PCI	SCSI card
PCI	Free
ISA	Shared/Free
ISA	Sound Card

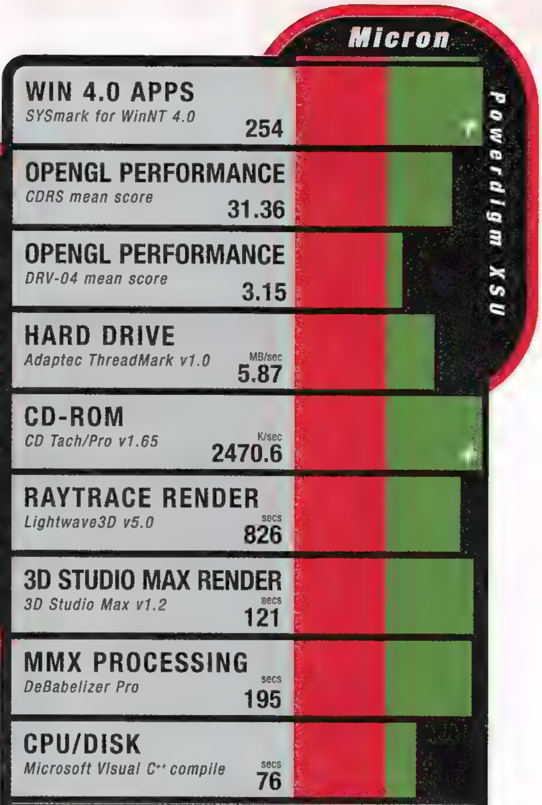
Micron's Samurai PCIset

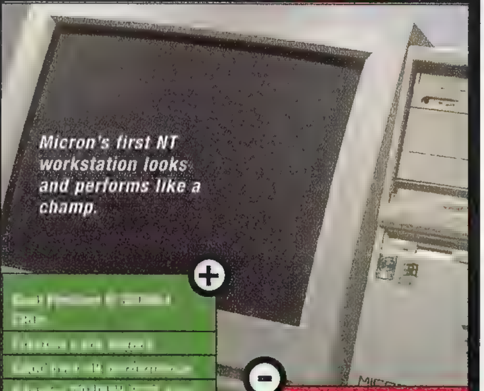
The Samurai PCIset, the first chipset to offer the 64-bit PCI, offers some things that Intel simply cannot. It's the first chipset to support the 64-bit/66MHz PCI 2.1 specification, with a sustained data rate of up to 400MB/sec. The chipset supports an in-order queue depth of eight, provides separate cache line read and write buffers, and optimizes the memory subsystem with support of up to 1GB of SDRAM and up to two Pentium II processors.

Samurai allows for lower latencies, which equates to higher PCI bus-master throughput. It also enables the system to run the PCI bus at 66MHz/64-bit; supports up to two Pentium II processors; provides support for up to 1GB of SDRAM memory; creates larger queue depth (eight vs. four) for better throughput and concurrency for heavily loaded multiprocessing systems; offers separate cache line read and write buffers for multiple processors; and provides better concurrency. No requirement to share resources allows for lower latencies, which means higher PCI bus-master throughput. In addition, the memory subsystem is one to two cycles faster than competing chipsets



GETTING A BIT CREATIVE
A genuine AWE-64 Value Edition sound card takes all those MIDI files and turns them into silky smooth wavetable synthesis.





Micron's first NT workstation looks and performs like a champ.

+
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

−
- No Ethernet connectivity
- No 1280x1024/true color
- No AGP
- Only five usable slots

Price $6,228 (as configured)
Company Micron
Phone 800.209.9686
URL www.micronpc.com

boot verdict 8

Note: Benchmark results were taken at a resolution of 1024x768/true color.

A complete breakdown of benchmark results is available on the *bootNet*. Point your browser to www.bootnet.com

Blade Runner

The real McCoy

CHECKLIST

Blade Runner
Version: 1.0

Maximum Resolution/Color
640x480/16-bit

Win95 Native

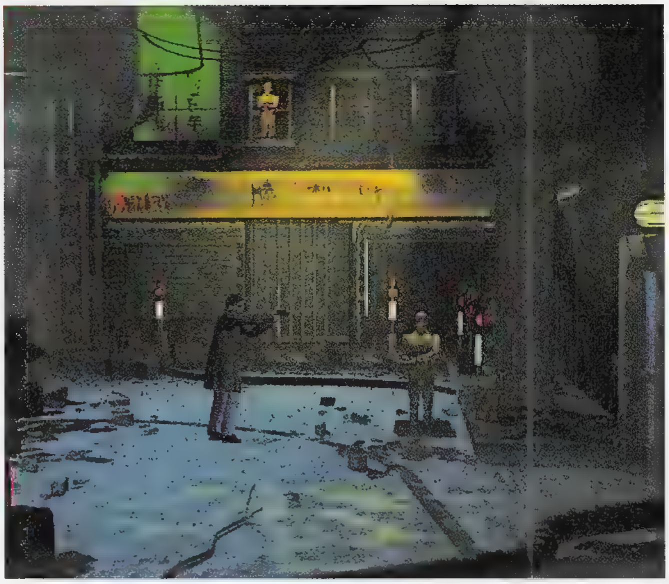
WinNT Compatible

DirectX
DirectDraw DirectSound

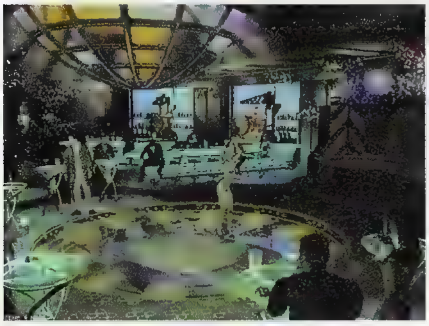
Multiple CDs

After some three years in vapor lock, the *Blade Runner* game has finally emerged. And it is engrossing. But while the game was in development, game technology surged forward, and *Blade Runner* wasn't able to keep up with all the advancements in real-time gaming, specifically texture-mapping and polygon-rendered characters and environments.

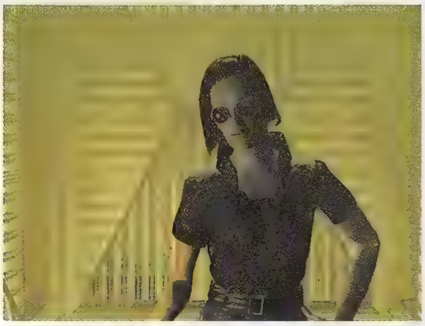
You "control" Blade Runner Ray McCoy through a dark yet strangely beautiful, futuristic Los Angeles. But this isn't the free-motion control that third-person games such as *Tomb Raider* have led us to expect; it's a point-and-click adventure game. Still, this glorified screen troller makes up for these limitations with mesmerizing lighting and special effects—all without hardware acceleration. The game's dynamic light sourcing lends an eerie sense of realism to all the pre-rendered environments—lights flash off and on while changing colors and direction, and objects and characters cast ominous shadows. Realistic raindrops pitter-patter on the streets as light is reflected on the wet pavement. Fog, steam, and mist rise on the horizon, adding just the right touches of foreboding and surrealism. In fact, the volumetric lighting effects are some of the most stunning we've ever seen. But make no mistake, under all this eye candy is one hell of a gaming experience.



As a Blade Runner you'll need to hone your shooting skills on the target range.



Blade Runner*'s intensely detailed scenery makes it intriguing to explore the seedier side of LA.*



Crystal, a fellow Blade Runner, can be your best friend or worst enemy.

Blade Runner the game takes place concurrent with the events in the film of the same name, so you'll meet several of the movie's characters and visit some familiar locations, such as Tyrell Corporation, but the story is completely new and original. By choosing between numerous paths—what love interests you pursue, whether you help or kill the replicants—you get a unique experience each time you play. Almost any character can be a replicant in one game and human in the next, including yourself. With all these options and seven possible endings, this is an adventure game with good replay potential.

Custom 3D models were built for every character, each containing 32,000 polygons and thousands of textures. The models were then animated using motion-capture technology. This is particularly evident in the fluid movement of your Blade Runner, although frames were obviously skimped for NPCs. Next, polygons were converted into voxels to allow higher frame rates. Unfortunately, larger voxel characters are blocky as all hell. Still, the upside is a game that never drops below 15fps. The downside is that the developers optimized the game engine for this passable pace; too bad they didn't set their sights higher. Nonetheless, the end result is incredibly detailed, realistic-looking characters well integrated with the environment.

Blade Runner's gameplay is stripped down, compared with traditional adventure games. There's no inventory system and you can't manipulate objects, so you won't find yourself fumbling to combine object A with object B to open door C. Instead, gameplay centers around finding clues and using your detective skills to solve the mystery. Interrogating suspects is a big part of your job as a Blade Runner, and important plot elements are decided based on how McCoy responds in a given situation. You can select one of four conversation modes based on the agenda you chose, but the best one is User's Choice mode, which displays a dialogue tree allowing the player to choose what McCoy says.

Blade Runners get all the cool high-tech toys, and Ray McCoy is no exception. At your disposal you have a Voight-Kampff machine for testing replicants, an Esper machine to analyze and search for clues in photographs, and your Knowledge Information Agent (KIA), sort of a PalmPilot circa 2014 to keep all your clues organized. You also have a slick spinner car; although you can't actually pilot the car, some of the best cutscenes come from cruising the airspace above of LA.

Blade Runner is one of those rare adventure games that gets most everything right. From its cutting-edge technology to its engrossing gameplay, *Blade Runner* is for anyone who dreams of electric sheep.

—Paula Reaume

Price $50
Developer Westwood Studios
Publisher Virgin
Phone 800.874.4607
URL www.westwood.com

boot verdict
8

If you don't do

SOMETHING…

RATING PENDING
RP
CONTENT RATED BY ESRB
kalisto
entertainment
DARK EARTH

…SOMETHING will do

SOMETHING to you.

Available on Windows®95.
Visit your local retailer or call
1-800-695-GAME day or
night (U.S. or Canada).

MICROPROSE

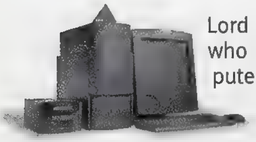
www.microprose.com

You are your own worst enemy in the moody world of Dark Earth. Debris fills the air and your flesh is being attacked by a deadly virus. Poisonous clouds drift and photosynthesis has ceased. Still, it is your mission to uncover a secret history that'll help restore the one thing that can save all of humanity–light. You'll uncover dark murder plots through real-time adventure and control treacherous combat as you interact with greedy and bizarre characters. Your foes envelop the City you protect. Whether you're there or not, they continue to prey upon you as you ponder your next move. But, there is a ray of hope–you simply have to find it. **www.darkearth.com**

Product Information Number 24

NEC Ready 9769

Graceless degradation



Lord help any witless newbie who drifts into his local computer store and walks away with this electronic snake oil. The Ready 9769 has all the trappings of a power box—266MHz Pentium II, second-gen DVD-ROM, "3D high-performance graphics"—but when you get past all the twinkly accoutrements and begin taxing real-world applications, you discover a collection of calculated concessions.

The Diamond T975 video card is the most egregious offender. It boasts the same Trident 3Dimage975 chipset employed by the Jaton Blaze3D Ultimate, which received a 4 bootVerdict back in *boot* 14. The T975 produced an unacceptable score of 17fps in the *Forsaken* Direct3D benchmark, and visual quality was awful compared to other silicon. The card couldn't pull off alpha-blending, textures were shimmery and banded, and texture seams were obvious. 3D acceleration aside, the card underperformed while drawing screens during the Sysmark32 test and proved to be ineffectual as a DOS gaming accelerator, helping the CPU pull only 12.2fps during our *Quake* test.

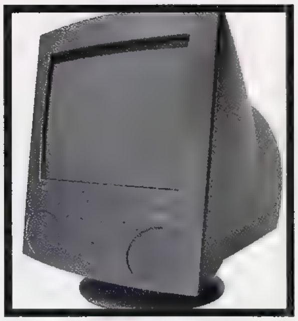
Diamond sells the T975 expressly to OEMs, no doubt to lower production costs. This is a nice deal for companies with the marketing muscle to redistribute crap, but little Timmy suffers when he can't enjoy this season's D3D games in all their superfast, polygonal glory.

As with bad D3D rendering performance, the Ready 9769's other faults might go unnoticed by newbies. DVD movie playback was prone to jaggies and blotchy color palettes—surprising considering MPEG-2 decoding is handled in hardware. And while the Hitachi GD-2000 second-gen DVD-ROM drive is a nice forward-thinking touch, its CD-ROM playback speeds were strangely atrocious, posting an ugly 1,587 during our CD-Tach test (that was the highest score from six test runs). We've gotten CD-Tach scores surpassing 2,100 from the GD-2000 before, so something must be amiss with NEC's implementation of this worthy drive.

NEC considers the Ready 9769 its "multimedia" powerhouse, but doesn't back up its promise with a rich sound card, speakers, or display. Smart manufacturers go with Ensoniq PCI sound cards, or at the very least Creative Labs AWE64s, but NEC settles for a crappy Aztech T4 "sound card" with FM synth and piddly hardware wavetable. Smart manufacturers go with Altec Lansing or Cambridge Soundworks speaker systems, but NEC settles for tinny tweety-bird speakers attached to an optional monitor. Finally, smart manufacturers go with 19-inch monitors, and drop down to 17-inchers in a pinch, but NEC is still pimping its anemic 15-incher, which is wrought with consistency flaws and can't even muster the resolutions and refresh rates offered by the T975 video card.

The sleek black mini-tower ships with an AirMedia Live pyramid that receives news reports over a wireless Internet connection. You also get a detachable "media control unit" that includes the floppy, DVD-ROM drive, and an LCD panel that displays system status reports. The ATX 440FX motherboard and active CPU cooling are nice touches, and hard drive performance is solid, but these pluses aren't enough to make the Ready 9769 anything more than another mass-market hoodwink intended for rubes who don't know any better.

--Jon Phillips



LOOKS PRETTY (UNTIL YOU TURN IT ON)

It's difficult to avoid the beguiling charms of a black monitor with integrated Harmon-Kardon speakers, but do not exercise this $379 option. The 0.28mm dot pitch, 15-inch CS-500 performed poorly in all *DisplayMate* tests and boasts a CRT that is inconsistent from unit to unit. The CS-500 that came with the Ready 9769 couldn't muster the promised 1280x1024@60Hz (or even 1024x768 at any refresh rate), but when we hooked up another CS-500 we had sitting around the bootLab, we got the numbers published on the spec sheet. The integrated speakers are Harmon-Kardon in name only, sounding like weak wind streaming through perforated wax paper.

under the hood

THE BRAINS	
CPU	Intel Pentium II 266MHz
L2 Cache	512K (internal)
RAM	32MB EDO DRAM (256MB max)
Motherboard	Intel Portland 440FX, ATX form-factor
THE BRAWN	
Video	Diamond T975 (Trident 975 chipset), 4MB
Hard Drive	Maxtor Comet 7GB EIDE
DVD-ROM	Hitachi GD-2000 with Diamond MPEG-2 decoder
Expansion	Three PCI, three ISA, one shared PCI/ISA
Fax/modem	Aztech 56.6Kbps x2 compatible
I/O Ports	Two USB, one parallel, two serial, one game/ MIDI, S-Video out, NTSC-video out, one SCSI (for media control unit)
THE BEAUTY	
Display	Optional 15-inch NEC CS-500 monitor (13.7-inch viewable); Invar Shadow Mask; 0.28mm dot pitch; max res 1280x1024@60Hz.
Sound	Aztech Labs T4 with AZT2320 chipset (FM synth and hardware wavetable)
Speakers	Harmon-Kardon, built into optional monitor
Other	Microsoft IntelliMouse, AirMedia Live wireless Internet receiver

EXPANSION MAP

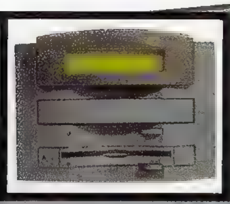
PCI	Diamond T975
PCI	Diamond MPEG-2 Decoder
PCI	Open
PCI	Open (shared)
ISA	Media control unit I/O controller (shared)
ISA	Open
ISA	Aztech modem/sound card

THE BUNDLE Microsoft Windows 95 | Merlin System Wizard | Microsoft Works | Microsoft Word 97 | Microsoft Greetings Workshop | Microsoft Encarta 97 Encyclopedia Microsoft Money 97 | Microsoft Bookshelf 97 | Microsoft Arcade | Microsoft Best of Windows Entertainment Pack Microsoft NetMeeting | Cover Up at Roswell | You Don't Know Jack | ABCs of Windows 95 | Mayo Clinic Family Health | 16 Million Business Phone Book | Presto! Photo Album | Presto! ImageFolio | Presto! VideoWorks | The Palace

boot	*down*
:57	:11

BRRR... BREAK OUT THE HOT TODDIES

Don't blame NEC if the CPU punks out. You get direct active cooling attached to the CPU itself and a second fan blowing a cold north wind over the processor just in case of emergencies.

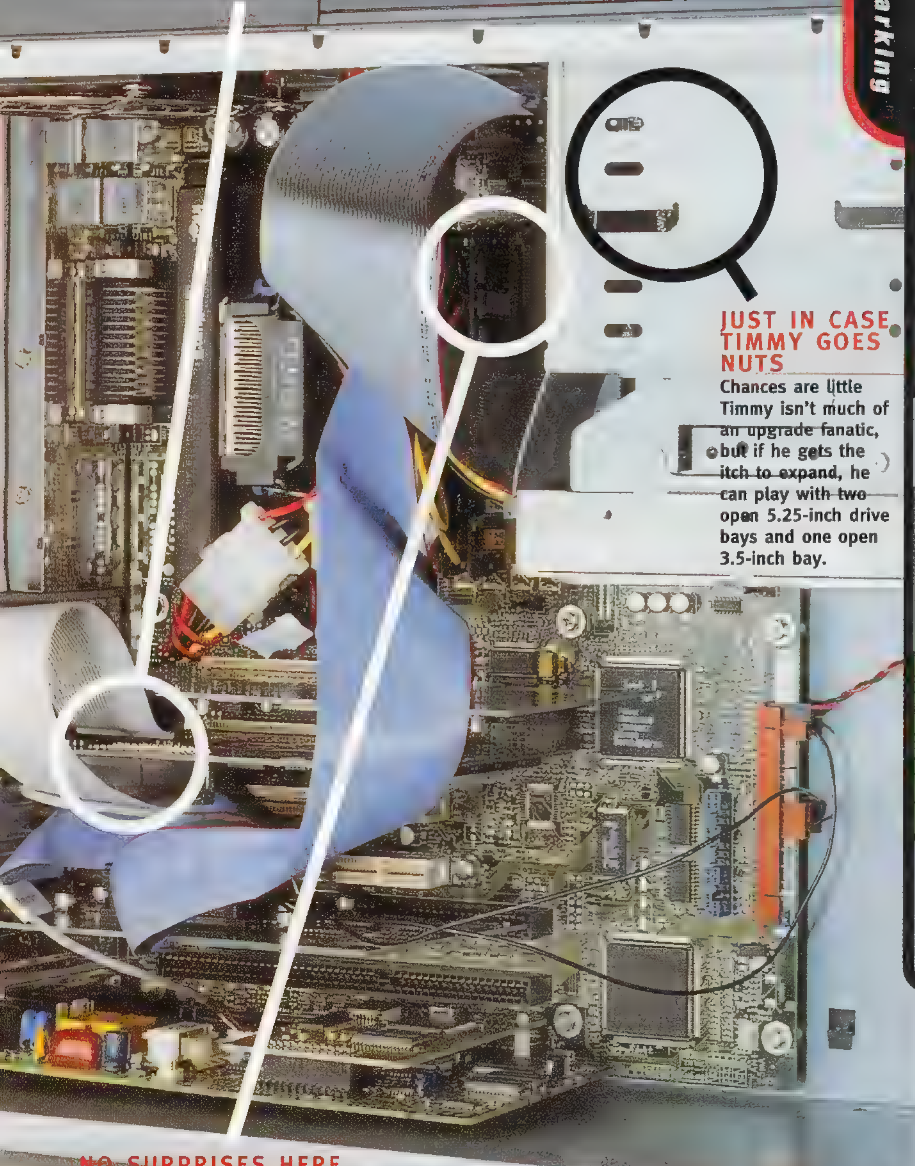


REPORTING FROM THE MOTHER SHIP

While NEC might skimp on power parts, it hit the money with its detachable Media Control Unit. Now you can stash your case underneath your desk, but still pop media in and out with ease. The LCD can signal time, date, [illegible] query, and the number of unviewed e-mail and faxes. A CD holder fits over the space [illegible] by the detached Control Unit.

THE ROOMS ARE VACANT BUT YOU CAN'T CHECK IN

[illegible]



JUST IN CASE TIMMY GOES NUTS

Chances are little Timmy isn't much of an upgrade fanatic, but if he gets the itch to expand, he can play with two open 5.25-inch drive bays and one open 3.5-inch bay.

NO SURPRISES HERE

Four SIMM sockets get you up to 256MB of memory—hope you're happy with the two 16MB modules pre-installed. All in all, the Ready's CPU, PCIset, and memory performed as expected. It's all the other parts that sucked.

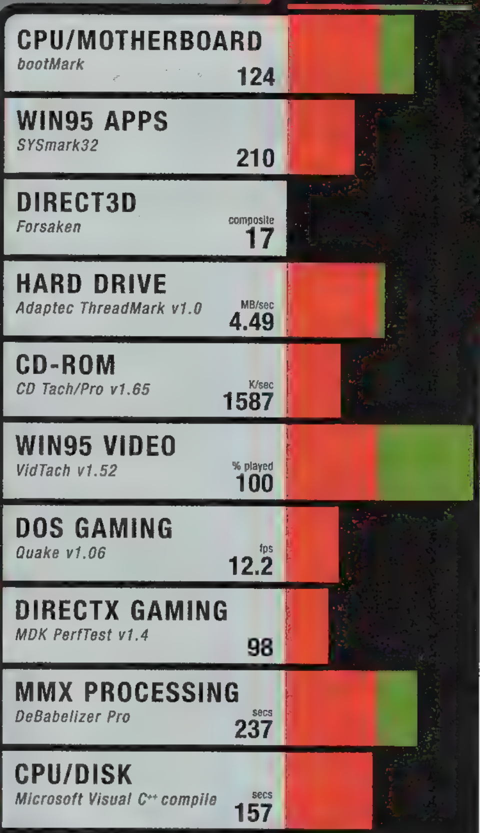
BLACK IS STILL BEAUTIFUL

Props to NEC for maintaining the Ready line's sophisticated black color scheme. And this time around, the company gives users the ability to toggle off Merlin, the Ready's system wizard. With Merlin removed from system overhead, speed increases across the board.

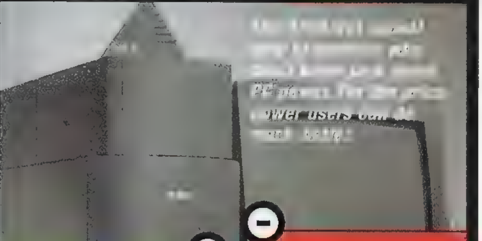
real-world benchmarking

NEC

Ready 9769



Test	Benchmark	Unit	Score
CPU/MOTHERBOARD	bootMark		124
WIN95 APPS	SYSmark32		210
DIRECT3D	Forsaken	composite	17
HARD DRIVE	Adaptec ThreadMark v1.0	MB/sec	4.49
CD-ROM	CD Tach/Pro v1.65	K/sec	1587
WIN95 VIDEO	VidTach v1.52	% played	100
DOS GAMING	Quake v1.06	fps	12.2
DIRECTX GAMING	MDK PerfTest v1.4		98
MMX PROCESSING	DeBabelizer Pro	secs	237
CPU/DISK	Microsoft Visual C++ compile	secs	157

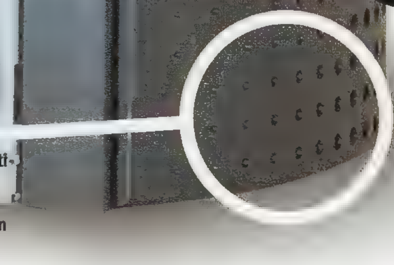


[illegible] PC players. For the price power users can do much better.

+	−
Detachable media control unit	Rinky-dink 3D
Good hard drive	Rinky-dink 2D
Active cooling on CPU	Rinky-dink sound
unalarming CPU/MMX/motherboard performance	Rinky-dink display
black case	Sloppy DVD movie playback
	No DVD software bundle
	Bad CD-ROM read times

Price **$2,699,**
$379 for optional monitor
Company **NEC**
Phone **800.524.0819**
URL **www.nec.com**

boot verdict 4



C[illegible]down of benchmark results is available [illegible]oint your browser to [illegible]

K56flex Modem Roundup

Three 56Kbps modems flex their stuff

The modem companies are celebrating their new 56.6Kbps modems as the answers to your bandwidth gloom. Our real-world tests, however, indicate that 56.6Kbps modems fall well short of their advertised transfer rates.

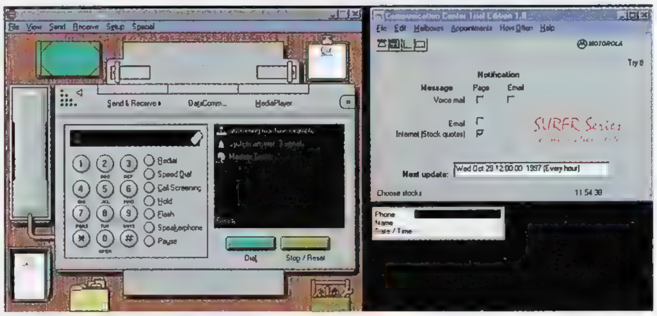
We rounded up three K56flex modems and ran them through three tests to illustrate what you might experience if you decide to upgrade from your 28.8 or 33.6 (we're saving modems that use x2, another 56.6Kbps technology, for another day). The first test was a web page download. We timed the entire download from connection to completion using a good old stopwatch and some quick hand-eye coordination (for control purposes, the page—which included text, GIFs, and Java—was served from a password-controlled server to ensure no other users would be requesting at the same time). The other two tests were simple FTP downloads. One was a 1MB .WAV file (notorious for not compressing nicely), while the other was a 1MB text file (which compresses well).

Always remember: 56.6Kbps is a theoretical limit that can be reached only under ideal conditions. Even in our brand-new bootLab, we were only able to connect at a maximum of 40Kbps with any of the modems tested (chalk it up to line noise, a problem many of our readers also encounter). You may experience better or worse connection speeds depending on the physical wiring between you and your phone company. Finally, while we were disappointed by our testing results, we acknowledge that line noise also degrades throughput for 33.6Kbps and 28.8Kbps modems.

—Daevid Vincent

Motorola **voiceSURFR**

The installation of the voiceSURFR took the better part of a day and included several driver re-installs. The process also required the manual installation of the Microsoft UNIMODEM/V driver: Drag a directory off the CD-ROM onto your hard drive, install the driver from there, remove the voiceSURFR drivers you just installed, reboot, and reinstall them again. This process is too complicated for such a simple device, and none of the other modems in this roundup required this chore. The software bundle includes a trial subscription to Epoch Net, and this was a hassle to get working, too.



Notification

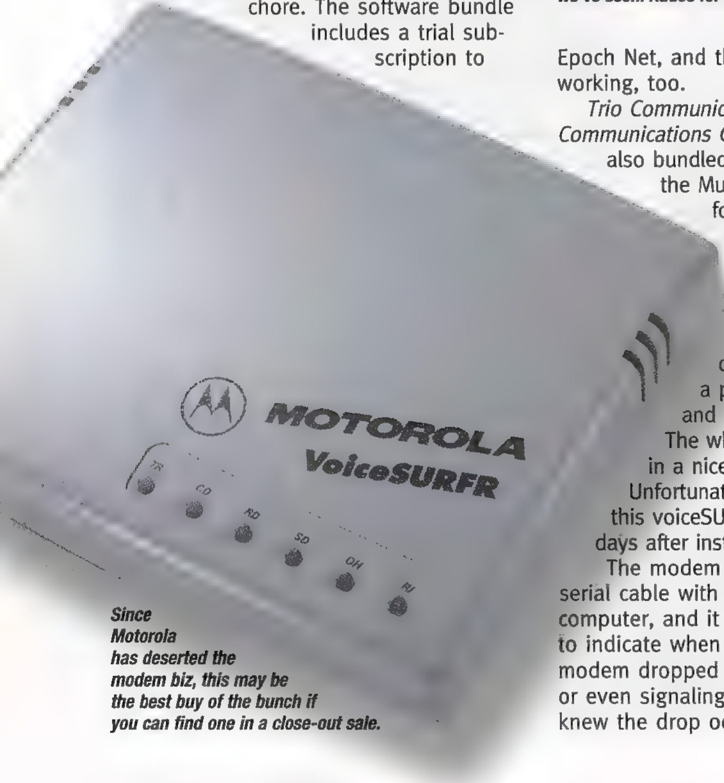
Message	Page	Email
Voice mail	☐	☐
Email	☐	
Internet (Stock quotes)	☑	

Next update: Wed Oct 29 12:00:00 1997 (Every hour)

Communications Center Trial Edition 1.0 ***is one of the few commercial Java application we've seen. Kudos for breaking convention.***

Trio Communications Suite 5.1 and *Communications Center Trial Edition 1.0* are also bundled. For more on *Trio*, see the MultiTech review below. As for *Communications Center*, it was written in Java, which makes it quite intriguing. It will notify you of new e-mail containing specific keywords, check stock quotes, notify a pager, handle voice mail, and schedule appointments. The whole shebang is displayed in a nice ticker tape fashion. Unfortunately, the best software in this voiceSURFR package expires 30 days after installation. Double bunk.

The modem doesn't come with a serial cable with which to connect to your computer, and it has no internal speaker to indicate when it's dialing. Twice, the modem dropped carrier without warning or even signaling the other processes. We knew the drop occurred only because the lights went out. The modem does come with a five-year warranty, and the price is by far the cheapest of the bunch—a saving grace, although given Motorola's announcement that it is exiting the modem business, it might not help you in the long run. If you can handle the headaches and already subscribe to a K56flex-enabled ISP, this isn't such a bad way to go—if you're too cheap to pay for finer amenities.



Since Motorola has deserted the modem biz, this may be the best buy of the bunch if you can find one in a close-out sale.

boot verdict 6

Price ***$103***
Company ***Motorola***
Publisher ***GT Interactive***
Phone ***800.426.6336***
URL ***www.mot.com/modems***

Shark Multimedia **Leopard XT**

The second product we tested was the Leopard XT, from a small upstart called Shark Multimedia. It fared well against the Motorola in FTP tests, but couldn't hang in the general-purpose web page test. The modem does come with serial cable, and it even has a pass-through. As with the Motorola voiceSURFR, there is no internal speaker, so an external pair will be needed if you wish to hear the modem dial. This modem also supports both the

Since when do sharks give birth to leopards? This baby was stillborn.

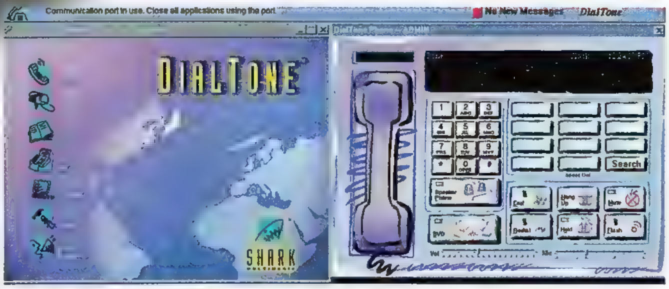
ASVD and DSVD specs, and the speakerphone works even when the PC is off.

Dial Tone 1.0, an answering machine/voice mail/pager notifier, comes bundled with the modem, but its interface is more elaborate than *we* need; an ugly enough interface to be a dealbreaker. This software is also unstable. It actually locked up the modem on a couple of occasions, requiring a cold reset (but that's what you get with 1.0 versions).

Finally, the modem's mere three-year warranty tells us that the manufacturer views its product as having a short life span, in contrast to Motorola and Multi-Tech.

Price $150
Company Shark Multimedia
Phone 800.800.3321
URL www.sharkmm.com

boot verdict 5


Communication port in use. Close all applications using the port
No New Messages
DialTone
DIALTONE
SHARK
Search

The Dial Tone Software 1.0 *interface is a bit more than we want.*

Multi-Tech Systems
MultiModem MT5600ZDX

Last but not least is our favorite in this roundup. The modem is small and compact, and could easily be carted around with a notebook computer or tucked away some place where a only small footprint is available. This is the only modem we reviewed that had an internal speaker, although it does make a slight hissing sound at power-up. It's also the only modem to come with a nice fat manual instead of a wimpy folding card or online documentation. And driver installation was quick and painless.

Trio Communications Suite 5.1 seems to be the package of choice. This is a solid, highly graphical program, and a good all-around communications center. Fax and voice-mail management, caller ID, a distinctive ring, and a terminal program are present and accounted for. The cheesy "desk" motif might be nice for newbies, but is insulting to power users. Perhaps worse is that it's not installed via *Install Shield* and thus isn't uninstallable via the Windows 95 Control Panel. Nor does it include an uninstall program.

Multi-Tech is so cool as to put a sticker on the front of the box that states, "The speeds achieved by 56K modems over U.S. telephone lines will be less than 56K and are otherwise dependent upon line conditions and other factors." Honesty is the best policy, and we appreciate Multi-Tech's candor. Unfortunately, this is the only modem that is not a voice modem as well, but Multi-Tech also sells a voice model should you require that feature.

MultiModem
56K
Multi
Systems

Ironically, the only nonvoice modem in the bunch has an internal speaker.

The price is a tad steep, considering its lack of voice capabilities, but the product feels solid and performed very well in all our tests. That combined with the pluses above make it a solid choice. Did we mention it has a ten-year warranty?

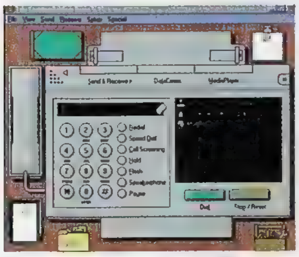
Price $159
Company Multi-Tech Systems
Phone 800.328.9717
URL www.multitech.com

boot verdict 7

Dare to Compare

	Web Page Load seconds	WAV Test DL Time KB/sec Bytes/sec	TEXT Test DL Time KB/sec Bytes/sec
voiceSURFR	40:00	4:03	1:46
		4.14	10.67
		4243	10931
Leopard XT	42:72	4:03	1:47
		4.14	10:57
		4243	10828
MultiModem	34:78	4:02	1:47
		4.16	10:57
		4260	10828

Over a three-day period, we tested one modem per day. Each modem was tested morning, noon, and night; scores above reflect highest throughput attained.

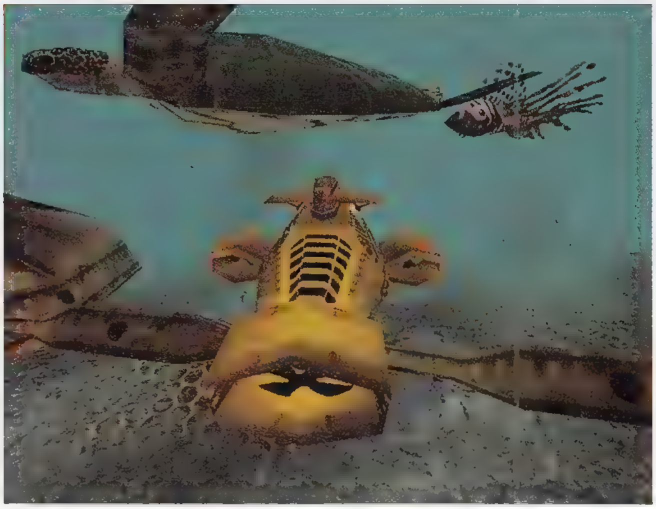


Both the Motorola voiceSURFR and the Multi-Tech MultiModem use the same Trio Communications Suite 5.1, which is very robust and adds considerable productivity to these packages if you intend to use your modem for something other than PPP connections.

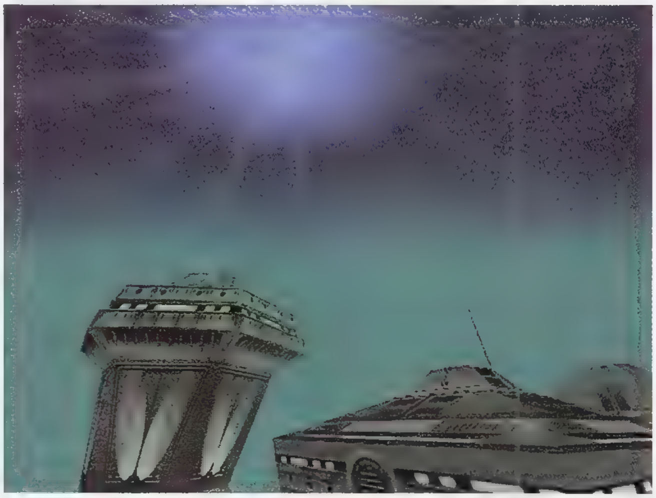
Sub **Culture**

TRY IT ON THE DISC

Under the sea



Sub Culture *immerses you in a beautiful 16-bit, texture-mapped polygon world.*



Sunlight breaking through the water's surface is a testament to **Sub Culture's** *advanced dynamic lighting effects.*

Sleep with the fishes as you journey to the bottom of the ocean and meet a race of tiny creatures in Ubi Soft's 3D action/adventure game *Sub Culture*.

Sub Culture is an open-ended game allowing players to accept missions or just explore their surroundings. As a freelance mercenary running dangerous missions, you trade goods at the various cities and bring peace to your underwater world. With war raging between the two undersea nations, the Procha and the Bohine, there's no lack of work. Trading is integral to the game, as the player must have a way to upgrade her equipment. You can make money through prospecting for ore, pearls, and scrap metal, or by completing the missions, which advance the plot. As the plot develops, the warring factions realize they're not each others' enemies but instead share a common threat, pollution. It's up to Bubba to clean up his world and destroy the pirates polluting it.

CHECKLIST

Sub Culture
Version: Release

Maximum Resolution/Color
640x480/16-bit

Win95 Native

3D Acceleration
Direct3D

Native 3D Hardware Support
Rendition Verite
3Dfx Voodoo PowerVR

DirectX
DirectDraw DirectSound
DirectInput

Specialty Controllers
Force feedback

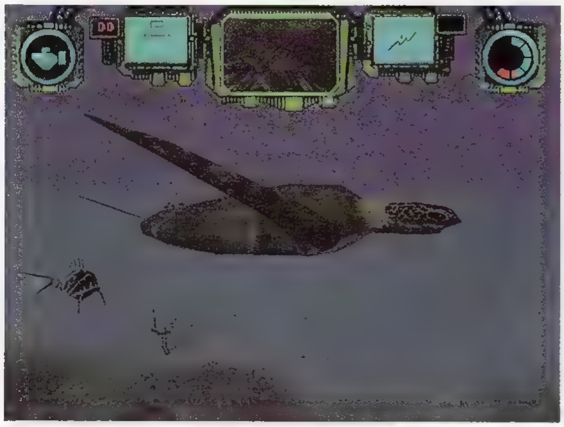
Sub Culture was built using Criterion Studios' proprietary Dive game engine, an enhanced version of Renderware. It's a visual treat to explore this beautiful, fully rendered underwater world. The game supports 3Dfx, Rendition Verite, and PowerVR chipsets directly, with all other 3D accelerators supported through Direct3D. There's also a plain-vanilla Win95 version for folks who lack a 3D card, but without the lighting effects and texture mapping, the game isn't nearly as dazzling to look at.

Playing on a P200 MMX with a 3Dfx card is nothing short of breathtaking. Day-to-night cycles showcase *Sub Culture*'s realistic light sourcing, illuminating the world in a subaquatic blue-green hue. Lens flare and light rays from the sun penetrate the water, creating a spectacular sight. During the night, the player must use the sub's deep-sea lights or flares to light up the murky depths. Other effects include dappling, which gives the impression of light being refracted through the water. The game uses Gouraud shading, texture-mapped polygons ranging from 300 for the sub to 2,000 for the surrounding environment, and anti-aliasing, which all add up to a stunning underwater world.

All objects and creatures have been designed using realistic physics models, which affect movement through the water. Never does the player feel like he's just moving through open space. For example, if you stop your sub, you'll drift. This can make it difficult to accurately line things up, but at the same time it gives a realistic feeling of being in the water, further immersing the player into this deep-sea environment. Force-feedback support provides the final layer of environmental immersion, with collisions shaking the ship and explosions rocking your world.

All in all, *Sub Culture* is a delightful romp through a beautiful underwater world that may leave adrenaline junkies hungry, but will certainly dazzle everyone with its graphics.

—Paula Reaume



The five guages that make up the HUD can each be retracted to get a better view.

Price *$50*
Developer *Criterion Studios*
Publisher *Ubi Soft*
Phone *800.824.7638*
URL *www.ubisoft.com*

boot verdict 8

AD INDEX

COMPANY	URL/PHONE #	PAGE NUMBER	PRODUCT INFO NUMBER
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ALPS Electric	www.alpsusa.com	26	89
AME Group Corporation	(626)338-8819	103	150
American Institute for Computer Science	www.aics.com	98	—
Animagic	www.animagic.com	98	88
ATI	www.atitech.com	4	85
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Sony Electronics, Inc.	www.sony.com/technology	22	—
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Yahoo! Inc.	www.yahoo.com	33	—

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www.bootnet.com

A **Plethora** of **Permedia** 2

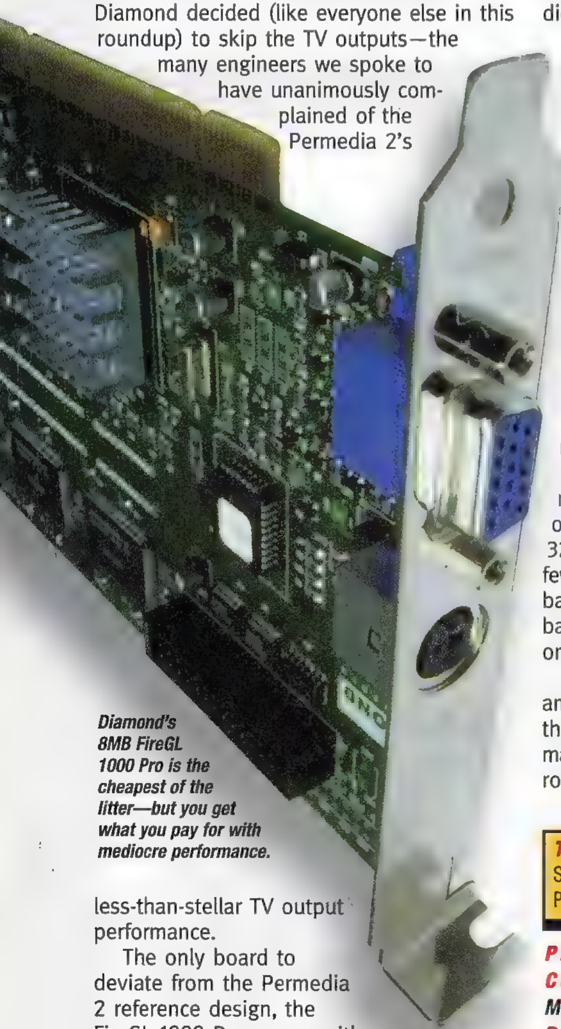
Card makers open up with 3Dlabs' latest 3D accelerator

While everyone else is concentrating on D3D, the Permedia 2 is one of the few boards aimed at entry-level OpenGL acceleration. Besides giving you phat OpenGL performance, Permedia 2 offers an all-in-one PCI/AGP (1x sidebands) solution supporting DirectX (and D3D hardware acceleration), flash BIOS upgradability, and access to 8MB of SGRAM/SDRAM. Throw in the integrated 100Mflops floating-point geometry setup engine, and the Permedia 2 may be a contender in the hotly contested all-in-one solution. But have your copy of Display Doctor 6.0 *if you want to play VESA 2.0 games because the current BIOS revs showcased here don't support it.*

—Andrew Sanchez

Diamond FireGL 1000 Pro

Armed with a 230MHz RAMDAC, the FireGL 1000 Pro continues Diamond's heritage with 8MB of fixed 100MHz SGRAM. This PCI/AGP board is the only board in this roundup with outputs for LCD glasses support. Diamond decided (like everyone else in this roundup) to skip the TV outputs—the many engineers we spoke to have unanimously complained of the Permedia 2's less-than-stellar TV output performance.



Diamond's 8MB FireGL 1000 Pro is the cheapest of the litter—but you get what you pay for with mediocre performance.

The only board to deviate from the Permedia 2 reference design, the FireGL 1000 Pro comes with Diamond's robust InControl 95 applet for all your tweaking and twisting.

But under scrutiny, the FireGL 1000 Pro turns in average benchmark results. The lack of VESA 2.0 support means no SVGA DOS apps without *Display Doctor.* While it failed to garner any top-notch scores, it did tussle for second place honors with the AccelSTAR II under *Final Reality.* The only D3D features not supported are vertex alpha and multiplactive alpha, which resulted in a thin black edge.

But, the AccelSTAR II and the Dynamite 3D/GL thoroughly trounced the FireGL 1000 Pro in *X,* regardless of the resolution tested. Overall visual quality is still levels below what Voodoo and Vérité deliver, though (see sidebar). Thankfully, the drivers handled *X*'s other alpha-blending modes and *Jedi Knight* transparencies just fine. But Viewperf/OpenGL performance proved uninspiring, with the AccelSTAR II's optimized drivers eking out faster frame rates. MPEG-1 playback is pretty good overall, although full-screen 1280x1024/32-bit color had the scalar stuttering every few seconds. Dropping the color depth back down to 16 bits brought playback back to smooth-as-silk performance, with only a hint of compression shimmering.

It may be the cheapest of the bunch and include LCD shutter-glass output, but the FireGL 1000 Pro's lackluster benchmarks just don't compare, despite the robust software bundle.

THE BUNDLE Caligari Truespace 3 SE | Crystal3Dimpact! | COSMO Player 2.0

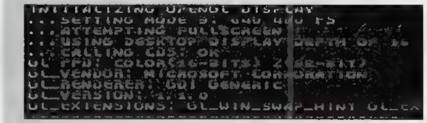
Price $249 (8MB version)
Company Diamond Multimedia
Phone 800.468-5846
URL www.diamondmm.com

boot verdict 6

Of OpenGL and Quake Mania

While each company reviewed here did not include Win95 GL drivers for mondo Quake-ery, 3Dlabs supplies reference drivers for proper ICD performance. Like most reference drivers, they'll be stripped of the extra bells and whistles video card makers love to bundle.

The easiest way to check whether any card (including these Permedia 2 boards) is Quake-ready is to rename the current OPENGL32.DLL. Then, try executing GLQuake *or* GLHexen 2. *Without the OPENGL32.DLL file within the subdirectory, the game will search for the nearest OPENGL32.DLL—usually found inside your windows or windows\system folder. If all is successful, the game detects your GL driver and loads accordingly.*



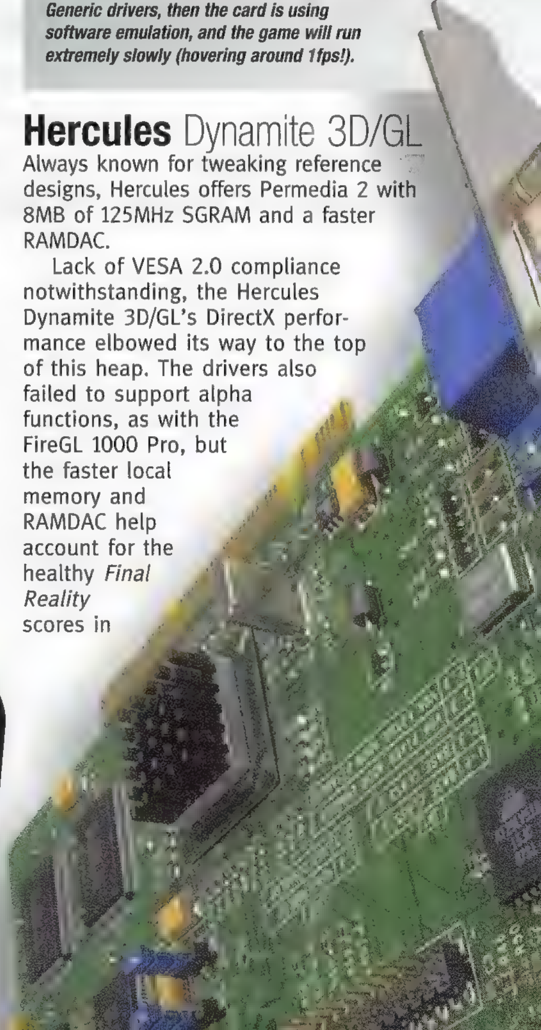
```
INITIALIZING OPENGL DISPLAY
...SETTING MODE 3: 640 480 FS
...ATTEMPTING FULLSCREEN
...USING DESKTOP DISPLAY DEPTH OF 16
...CALLING CDS: OK
GL PFD: COLOR(16-BITS) Z(32-BIT)
GL_VENDOR: MICROSOFT CORPORATION
GL_RENDERER: GDI GENERIC
GL_VERSION: 1.1.0
GL_EXTENSIONS: GL_WIN_SWAP_HINT GL_EX
```

If you see that the game loads the Microsoft GDI Generic drivers, then the card is using software emulation, and the game will run extremely slowly (hovering around 1fps!).

Hercules Dynamite 3D/GL

Always known for tweaking reference designs, Hercules offers Permedia 2 with 8MB of 125MHz SGRAM and a faster RAMDAC.

Lack of VESA 2.0 compliance notwithstanding, the Hercules Dynamite 3D/GL's DirectX performance elbowed its way to the top of this heap. The drivers also failed to support alpha functions, as with the FireGL 1000 Pro, but the faster local memory and RAMDAC help account for the healthy *Final Reality* scores in

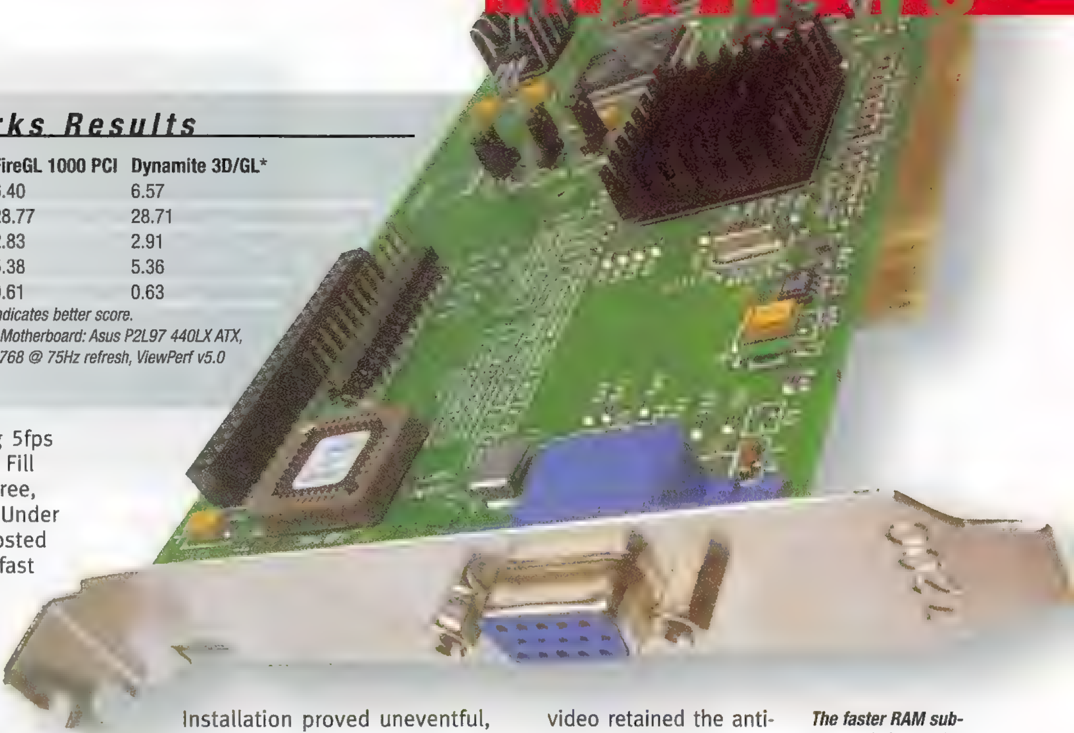


Viewperf Benchmarks Results

Benchmark	AccelStar PCI	FireGL 1000 PCI	Dynamite 3D/GL*
Awadvs-01	**6.77**	6.40	6.57
CDRS-01	**30.14**	28.77	28.71
DRV-04	**3.06**	2.83	2.91
DX-03	**5.73**	5.38	5.36
Light	**0.642**	0.61	0.63

All results are measured in frames per second. Bold indicates better score.

Testing Methodology *CPU: Intel Pentium II 233MHz, Motherboard: Asus P2L97 440LX ATX, RAM: 64MB of SDRAM, OS: Windows NT 4.0 at 1024x768 @ 75Hz refresh, ViewPerf v5.0*



The faster RAM subsystem helps push the Hercules Dynamite 3D/GL ahead of the pack.

the Robots and City scene (scoring 5fps faster than its closest competitor). Fill rates are also the fastest of the three, pushing a good 32.05Mpixels/sec. Under 640x480 *X*, the Dynamite 3D/GL posted an impressive 48.7fps—almost as fast as last month's Kick-Ass Diamond Stealth II S220, despite the lower overall visual quality. MPEG-1 performance is consistent with the other Permedia 2 boards benchmarked here.

On the NT tip, the Dynamite 3D/GL edged out the FireGL 1000 in three of the five Viewperf results. While it couldn't catch the AccelStar II's GL performance, it certainly held its own.

The Dynamite 3D/GL edged out everyone under D3D performance and put up a good fight under NT.

THE BUNDLE SciTech's Display Doctor I Intervista Worldview I Micrografx Picture Publisher I Caligari TrueSpace3 HE I Starfleet Academy

boot verdict 8

Price ***$349 (8MB version)***
Company ***Hercules***
Phone ***800.532-0600***
URL ***www.hercules.com***

AccelGraphics
AccelSTAR II

You've heard of AccelGraphics if you've been in the high-end OpenGL scene. But with the AccelSTAR II, the video card maker comes down to earth. Like the FireGL 1000 Pro, the AccelSTAR II sports 8MB of non-upgradable SGRAM linked to a 230MHz RAMDAC and comes in AGP and PCI flavors. Like everyone else here, TV outputs are MIA.

The AccelSTAR II is AccelGraphic's entry-level video card and draws from the company's experience with high-end OpenGL for optimized performance.

Installation proved uneventful, but the AccelSTAR II's lone control panel applet seems naked compared to the heftier Hercules and Diamond offerings.

AccelGraphics claims to have tweaked the 3Dlabs' reference drivers to get maximum performance, and that poking and prodding shows in the benchmark results. The AccelSTAR II battled tooth-and-nail with the FireGL 1000 Pro. As before, the AccelSTAR II's drivers could cough up those two alpha modes, which resulted in black trimming throughout *Final Reality*. Under *X*, the AccelSTAR II edged out Diamond's board by a good 2fps, regardless of resolution, and performed all those cool alpha effects. Viewperf/OpenGL performance consistently pushed pass the FireGL 1000 Pro across the board, while MPEG-1 video retained the anti-aliased edges and smooth 16-bit color playback that all these boards present.

It's a little more expensive than the FireGL 1000 Pro, and it may not have the sweet software bundle, but in the OpenGL performance race, the AccelSTAR II inched passed the competition.

THE BUNDLE None

boot verdict 8

Price ***$279 (8MB version)***
Company ***Accelgraphics***
Phone ***408.546.2100***
URL ***www.accelgraphics.com***

Dare to Compare

	AccelStar II	FireGL1000 Pro	Dynamite3D/GL
Max 24-bit resolution/refresh	1280x1024/100	1280x1024/60	1280x1024/90
Max 16-bit color-depth/refresh	1600x1200/75	1920x1080/75	1600x1200/90
VESA 2.0 Support NO	NO	NO	
Virtual Desktop Support	NO	NO	NO
MDK PerfTest	110	99	109
Quake 640x480	failed	failed	failed
Quake 800x600	failed	failed	failed
Quake II Test 640x480 (software)	failed	failed	failed
X 640x480	45.91fps	42.65fps	48.76fps
X 800x600	35.62fps	32.63fps	37.82fps
Final Reality Overall	2.59 R-Marks	2.54 R-Marks	2.63 R-Marks
FR 3D	2.96 R-Marks	2.86 R-Marks	3.03 R-Marks
FR Polygons	218.62 Kpoly/sec	182.9 Kpoly/sec	217.71 Kpoly/sec
FR Fill Rate	29.76 Mpixels/sec	26.47 Mpixels/sec	32.05 Mpixels/sec
FR Robots	29.76fps	34.01fps	36.17fps
FR City	24.49fps	35.82fps	40.07fps

Testing Methodology *CPU: Intel Pentium II 233MHz Motherboard: ASUS P2L97 440LX ATX RAM: 64MB of SDRAM OS: Windows 95 OSR 2.1 at 1024x768 @ 75Hz refresh*

Myth: The Fallen Lords

Hit and myth

TRY IT ON THE DISC

The luxuriant spectacle of *Myth: The Fallen Lords* takes the genre of real-time strategy games to new heights. Emphasizing the rush of bloody combat over intensive resource management, Bungie has forged one of the most spectacular (and gory) physics engines around. Lobbing a grenade into an oncoming horde will smear miasma across the field, leaving bouncing heads, flailing arms, and thick streams of blood. Few games can match the undiluted gore and devastation of a long battle in *Myth*. The spoors of war are permanent stains to the battlefield, with severed limbs, arrow shafts, and bodies strewn about.

Enhanced for 3Dfx cards (with a Rendition patch already out on Bungie's web site), the battlefields in *Myth* consist of stagnant bogs, small villages, and snowy mountainsides, all rich in detail and definition. A whopping 1,500 sprite-based troops can be used as fodder to add to the grisly pile of fallen warriors. Troop animations, however, are choppy, with an average of 6 frames per sprite. Control of these troops is particularly arduous, due to an awkward 30-degree camera angle and roughshod troop selection and positioning control. In addition, the single-player game is excessively difficult, sure to infuriate neophyte gamers. Fortunately, *Myth* is multiplayer through TEN, free bungie.net, or LAN via TCP/IP. However, the absence of IPX is disappointing.

A visual delicacy compromised only by its coarse interface, *Myth* is so very close to kicking ass. A compelling storyline, impressive graphics, and some of the goriest battles ever seen make *Myth* a contender for the crown of real-time strategy games. The finesse of fine control may be missing, but the epic spectacle of *Myth* delivers addictive gameplay with some innovative graphics.

—Dan Simpson

CHECKLIST

Myth: The Fallen Lords
Version: 1.0

Maximum Resolution/Color
640x480/16-bit

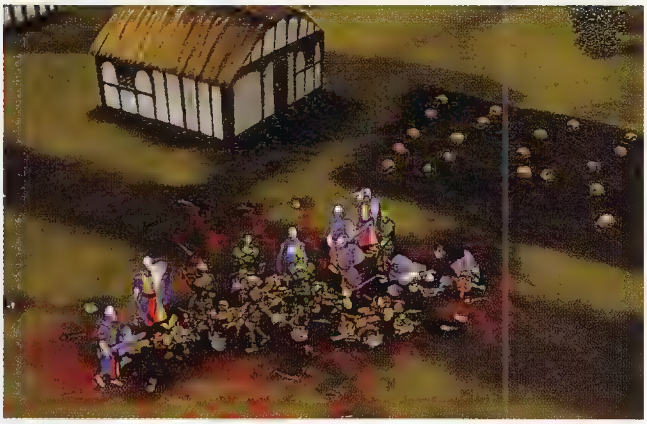
Win95 Native

WinNT Compatible

Native 3D Hardware Support
3Dfx Glide/Voodoo

DirectX
DirectDraw DirectSound
DirectInput

Multiplayer
LAN Modem Direct/serial
TCP/IP



The visceral carnage of Myth *is certainly not for the squeamish.*

Price $50
Company Bungie
Phone 800.295.0060
URL www.bungie.com

boot verdict 8

Altec Lansing **ACS495**

USB's sonic side

Altec Lansing's ACS495 is the first in a new line of digitally controlled speakers to take advantage of USB control.

This Dolby Pro Logic subwoofer/satellite combo consists of two pint-sized satellites, each containing two 3-inch full-range drivers, with the top speakers mounted 45 degrees off-axis (similar to Altec's ACS500, but not as gargantuan). A 6-inch dual-voice-coil woofer (crossed over at a non-adjustable 150Hz) sits inside a rear-ported acoustic suspension enclosure made from ½-inch particleboard, with the integrated amplifier pumping 5 watts per satellite and 20 watts to the sub. A mini DIN cable runs from each satellite into the subwoofer, which also contains twin 1.8-inch mini stereo inputs, as well as a solo USB connector.

Sitting on top of the right speaker is your volume control, with everything from subwoofer to surround level at your finger tips.

Connecting the ACS495 to the USB port allows you to control the speakers via the garish GUI. From here, you can test your level outputs by feeding your speakers pink noise, adjust the center channel, and more. The next incarnation of this GUI should be a smaller, lighter applet neatly housed in your Control Panel.

Thankfully, the ACS495 continues Altec's fine sonic tradition. The Surround Sound adds life, with the center channel locked in solidly front-and-center. Stereo separation is also readily apparent. Sonically speaking, these speakers sound a lot like the ACS45s, with warm midranges and a clean crossover between the satellites and subwoofer, resulting in rich, undistorted midbass seemingly coming from the satellites (although, like the ACS45s, these 3-inch drivers lack high frequency). The subwoofer reaches maximum at 60Hz to 80Hz, with bass response dropping off below 40Hz. Be careful when pumping ultra-low freqs down this puppy, as tremendous cone-rattling and extemporaneous wind noise become noticeable with the max volume.

Still, the combination of clean, uncompromising sound and cool USB controls makes the ACS495 a great place to start your USB accessorizing.

—Andrew Sanchez

Altec Lansing

These little bad boys sound as good as they look, and when you throw in USB control, the Altec ACS495 is a pretty cool character.

Price $199
Company Altec Lansing
Phone 800.258.3288
URL www.altecmm.com

boot verdict 8

Tomb Raider II

More of the same

CHECKLIST

Tomb Raider II
Version: 2.0

Maximum Resolution/Color
1280x1024/32-bit
Win95 Native
3D Acceleration
Direct3D
DirectX
DirectDraw DirectSound
DirectInput
Specialty Controllers
Win95 compatible

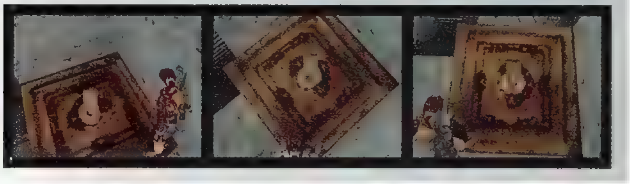
TRY IT ON THE DISC

With *Tomb Raider II*, Core Design made a sequel the Hollywood way: upping the scope and increasing the violence while ignoring the original version's flaws. In the gaming world, we call this "an add-on pack."

Tomb Raider II has the same lame-ass 2D sprites, pathetic camera placement, oxymoronic enemy intelligence, and atrocious clipping problems as the original. If sequels are the place for developers to address the original game's problems, maybe it's time to school Core all over again.

Sprites Among Us

In our review of the original Tomb Raider, *we devoted a sidebar to the hideous 2D sprites littered throughout the game. We were appalled to find the same 2D sprites floating around* Tomb Raider II. *As you can see from the screenshots below, 2D sprites present the same image when viewed from different angles, degrading an otherwise blissful world of 3D texture-mapped polygons. Core could've easily mapped these sprites as textures on a transparent brush (like the trees around Lara's home) but instead took the lazy way out.*



Lesson 1: Objects shouldn't pass through each other like Casper the Friendly Ghost. *Tomb Raider II*'s polygon collision detection and clipping is laughably inept. Whenever Lara gets close to a wall, she's bound to lose an arm inside it. And hand-to-hand combat is a mess of commingling body parts.

Lesson 2: There is an intelligent way to implement a chase camera. Nothing's worse than when the camera falls behind a wall during a heated gun fight. Smart camera placement is nothing new. *Mario 64* should be at the local video store by now. Rent it and learn.

It wouldn't be Tomb Raider *without ruthlessly killing some innocent endangered species.*

Lesson 3: 2D sprites are lame in a 3D polygon world. If you use sprites, at least map the textures to transparent brushes so the same flat image isn't shown, no matter which way the camera rotates (see sidebar).

Lesson 4: Enemy AI should involve more than running in circles. You can almost see *TRII*'s AI routines running during an enemy encounter: Start shooting and charge; once Lara is reached, run in circles. If walls limit running in circles, merge with Lara (see above).

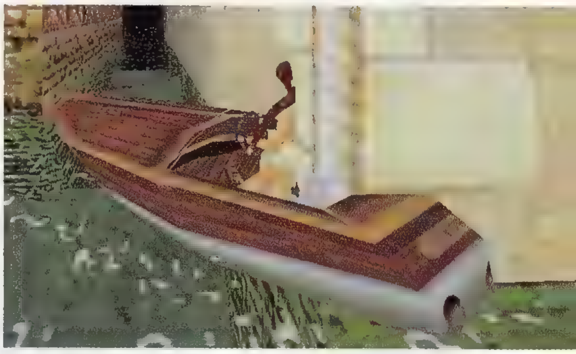
To Core's credit, it *has* done a good job lumping the various 3D card support into one coherent D3D package. And the setup utility for testing graphics options, such as Z-buffering and bilinear filtering, with different resolutions and color depths is a welcome addition. The game's lack of alpha-blending makes the PowerVR version at 800x600 (or even 1024x768 if your system can handle it) the best looking platform by far.

Texture maps have been upped, and newly added dynamic lighting effects make for some gorgeous visuals. Unfortunately the 18 new levels aren't as interesting as the original; although driving both the speedboat and the snowmobile are a blast.

Lara Croft's increased polygon count smoothes out the edges for a cleaner view at her overly rendered proportions. It's now even more apparent that *Tomb Raider II*'s main selling point is the ass of a scantily clad woman.

—*Sean Downey*

With Tomb Raider II, *Lara Croft comes this much closer to looking like a blow-up sex doll.*



Among the many dangers Lara faces in Tomb Raider II *are boat-eating buildings. This is an excellent example of how poor collision detection can ruin a game.*

Price $60
Developer Core Design
Publisher Eidos Interactive
Phone 800.616.2022
URL www.eidosinteractive.com

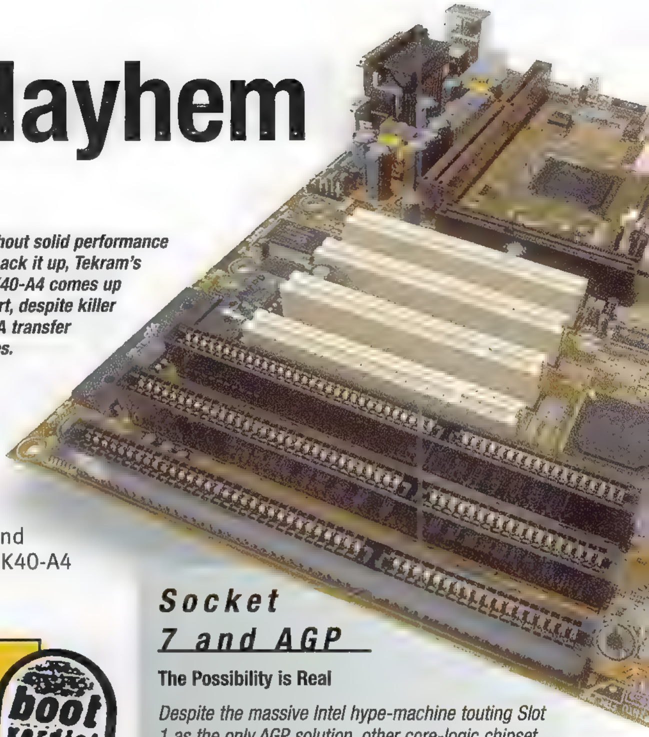
boot verdict
6

AGP Motherboard Mayhem

A smorgasbord of ATX Pentium II boards

The sheer variety of 440LX parts makes for great pickings when the inevitable occurs and it comes time to upgrade that weathered, pre-AGP motherboard for some serious P-II lovin'.

—Andrew Sanchez



Without solid performance to back it up, Tekram's P6K40-A4 comes up short, despite killer DMA transfer rates.

Tekram P6K40-A4

Tekram's latest ATX board comes with one AGP, three PCI, two ISA, and one PCI/ISA shared combo slot. The mainboard's jumper design is the only one in this roundup that allows 75MHz and 83MHz clock frequencies—although the 440LX officially supports only the 60/66MHz bus clock—with multipliers from 2.5x to 5.5x. USB connectors are thankfully located on the dual-layer ATX I/O connector, while four DIMM slots support up to 512MB of EDO DRAM or SDRAM.

Unfortunately, the P6K40-A4's performance is in the back of pack. DMA access speeds were the best of the bunch, but *Quake* frame rates just weren't as strong as expected. A mere 79MB/sec memory speed looks limp compared with the high 90s other boards exhibited. Even under the *Final Reality* AGP tests, the P6K40-A4 hovered at the bottom of the heap.

Despite solid construction and 83MHz jumper settings, the P6K40-A4 doesn't perform.

THE STATS: BIOS: Award v1.1 I RAM Support: 512MB of 3.3v SDRAM or EDO DRAM (ECC support)

Price $250
Company Tekram
Phone 510.353.6099
URL www.tekram.com

boot verdict 7

Socket 7 and AGP

The Possibility is Real

Despite the massive Intel hype-machine touting Slot 1 as the only AGP solution, other core-logic chipset manufacturers are going to war for Socket 7. High-speed Pentium-based CPU owners can get the chance to experience AGP texturing by throwing in one of many mainboards available from FIC, Abit, and Tyan that will use core-logic AGPsets from AMD, VIA, ALi, and SiS.

BCM KR630

The ATX mainboard from BCM comes with one AGP, three PCI, one ISA, and one PCI/ISA shared slot. Like many boards, the KR630 uses a jumper design with settings from 233MHz to 333MHZ (66MHz x 5). A 440LX AGPset (complete with heatsink) sits under the CPU.

Three DIMM sockets deliver up to 384MB of RAM, while all I/O ports are relegated to the ATX I/O connector. All components and connectors on the KR630 are cleanly laid out, although the CPU speed jumpers sit precariously close to a torroid coil and capacitor, making adjustments a chore.

During benchmarking, the BCM KR630 simply could not keep up, consistently sporting low scores. While some scores equaled the ASUStek P2L97, others fell below expectations, such as memory speed and overall *Quake* fps scores.

Why BCM decided against the extra PCI slot is beyond us; enough space is available to easily engineer one. That, coupled with uneven performance, puts the KR630 out of the money.

What Makes a Kick-Ass Motherboard?

We're often asked what would go into the perfect motherboard—one that would get a perfect 10 and the elusive Kick-Ass! Product Award.

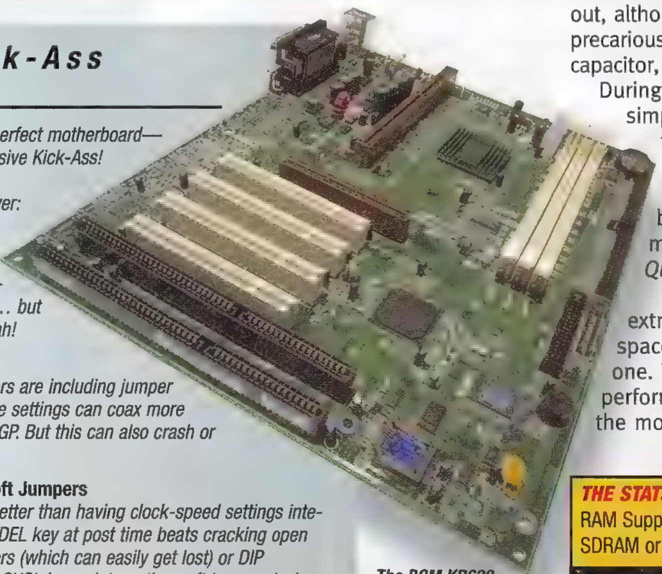
Well, here's what we would go ga-ga over:

At least five PCI slots
And more would rock harder than Pantera. Unfortunately, the only manufacturer that would do such a thing is Intergraph… but it doesn't sell motherboards separately—bah!

Ability to clock past 66MHz
Despite Intel's warnings, some manufacturers are including jumper settings for faster system bus speeds. These settings can coax more power out of your system, especially with AGP. But this can also crash or lock-up your system. Proceed with caution.

Jumperless clock-speed settings, aka Soft Jumpers
For the overclocking adventurer, nothing's better than having clock-speed settings integrated into your system BIOS. Pressing the DEL key at post time beats cracking open your tower case and monkeying with jumpers (which can easily get lost) or DIP switches. A few vendors, such as Abit and ASUStek, are integrating soft jumper designs with their mainboards.

USB ports on the ATX I/O connector
This one's a no-brainer, but it kills us to see USB header connectors on a board that requires you to surrender expansion slots for the USB ports.

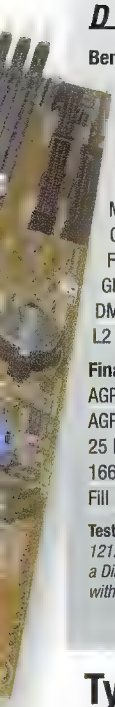


The BCM KR630 suffers from uneven performance and lackluster feature sets… and where's our fifth PCI slot?!

THE STATS: BIOS: Award v4.51G I RAM Support: 384MB of unbuffered SDRAM or EDO DRAM

Price $249
Company BCM
Phone 714.470.1888
URL www.bcmcom.com

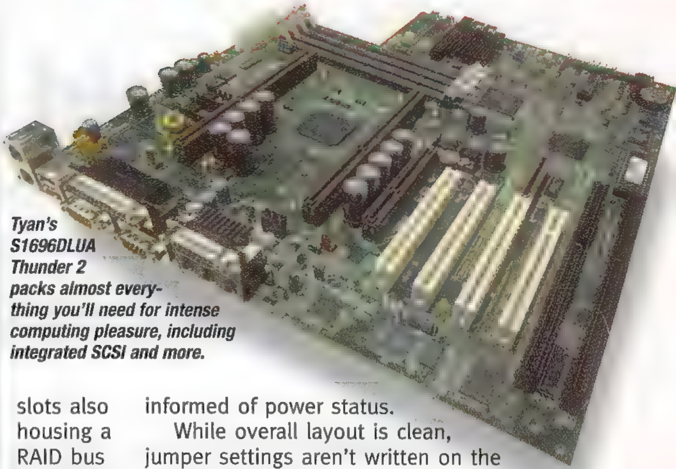
boot verdict 6



Dare to Compare

Benchmark	Tekram P6K40-A4	Tyan S1696DLUA	BCM KR630	Achme MS6111
CPU speed (CPU/overclocked)	233/266	233/266	233/266	233/266
bootMark	113.2/128.4	111.58/129.1	113.46/130.3	116.26/131.4
Memory speed (MB/sec)	79.7/92.7	101.0/100.8	86.2/90.0	97/101.3
MDK PerfTest	83/83	84/128	83/83	83/83
Quake (fps)	11.6/11.9	14.2/15	11.7/12	14.8/15.6
FastVid Quake (fps)	22.9/25.1	24.7/27.5	23.2/25.5	25.2/28
GLQuake (640x480) (fps)	33.4/33	33.4/33	32.9/32.9	33.4/32.1
DMA access (MB/sec)	87.6/88.4	82.64/83.26	50.5/51.1	82.72/83.5
L2 cache speed (MB/sec)	245/280	243.9/278.8	245/280	245.1/280.1
Final Reality/AGP Bus Tests				
AGP 16MB (fps)	44.8/49.21	49.35/53.25	48.50/53.93	50.06/53.98
AGP 12.3MB (fps)	51.88/59.64	55.19/64.95	56.74/63.49	58.15/65.23
25 Pixel (Kpoly/sec)	151.45/157.03	165.82/192.22	137.08/171.17	166.38/186.29
Fill Rate (Mpixel/sec)	38.33/38.29	38.45/38.42	38.32/38.29	38.33/38.29

Test Methodology: *CPU: Intel Pentium II 233MHz, Memory: 32MB of SDRAM, OS: Windows 95 OSR2.1 Build 1212b (with USB supplement), Video Cards: Rendition Vérité V1000 Reference board (with 4MB of EDO DRAM) and a Diamond Monster 3D (3Dfx Voodoo with 4MB of EDO DRAM), AGP Video Card (for AGP tests): ATI XPERT@Play with 4MB, Hard Drive: Quantum Fireball 1.2GB EIDE, CD-ROM: Mitsumi FX-120T 12x EIDE CD-ROM drive*



Tyan's S1696DLUA Thunder 2 packs almost everything you'll need for intense computing pleasure, including integrated SCSI and more.

Tyan S1696DLUA Thunder 2 ATX

The extended ATX form-factor S1696DLUA Thunder 2 is Tyan's top-of-the-line motherboard, personifying in-your-face integration.

Home to single- or dual-P-II configurations up to 300MHz, the S1696DLUA comes with one AGP, three PCI, one ISA, and one PCI/ISA shared slot, with one of the PCI slots also housing a RAID bus (for RAID 0, 1, and 5 support). An integrated Adaptec AIC7895 dual-channel Ultra Wide SCSI connector and a third Narrow SCSI connector are also on board. A Yamaha OPL-3-SA3 sound chip is included for basic FM synth and digital sound, although a Creative Labs chipset would've been more appropriate.

Four DIMM sockets accommodate up to 1GB of EDO RAM, while the ATX I/O connector has all necessary ports, including USB and audio I/O. Twin LEDs keep you informed of power status.

While overall layout is clean, jumper settings aren't written on the board itself.

On the performance tip, the Thunder 2 posted beefy scores, garnering first-place bragging rights in some benchmarks and maintaining a strong lead over the other two boards, especially in our AGP tests.

With strong overall performance and all the SCSI extras, the S1696DLUA Thunder 2 can't be refused.

THE STATS: BIOS: AMI v2.5 I RAM Support: 1GB of EDO or 512MB of SDRAM (5v or 3.3v and ECC support)

Price ***$499***
Company ***Tyan***
Phone ***408.956.8000***
URL ***www.tyan.com***

boot verdict 8

Tweaking Past the 66MHz Limit

While Intel's official party line is 66MHz, some 440LX boards allow you to overclock your system bus. It's just a matter of finding the correct jumper settings and experimenting. How much more performance will you get out of overclocking? We prodded Tekram's P6K40-A4 jumper settings, and here are the results.

For the AGP tests, we used ATI's Expert@Play: the only AGP 2x with sideband 3D accelerator shipping today.

Unfortunately, trying the 83x3.5 resulted in the system locking up at boot.

Benchmark	266MHz (66MHz x 4)	250 (83MHz x 3)
bootMark	128.5	121
Memory speed	92.7MB/sec	99.4MB/sec
MDK PerfTest	83	83
Quake (fps)	11.9fps	13.9fps
FastVid Quake (fps)	25.1fps	25.5fps
GLQuake (640x480)	33.0fps	32.9fps
DMA access	88.4MB/sec	108.7MB/sec
Final Reality/AGP Bus Tests		
AGP (16MB)	49.21fps	56.7fps
AGP (12.3MB)	59.64fps	58.64fps
25 Pixel	157Kpoly/sec	169.79Kpoly/sec
Fill Rate	38.29Mpixels/sec	38.41Mpixels/sec

Achme MS6111

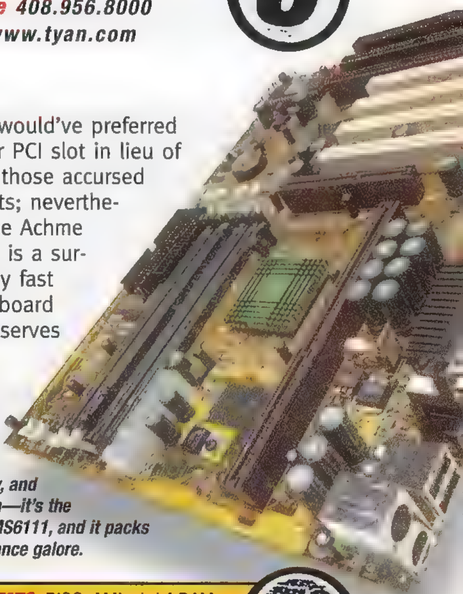
A newcomer to the bootLab, Achme's MS6111 is a standard ATX motherboard with one AGP, three PCI, two ISA, and one shared PCI/ISA slot.

Rather than jumpers, the MS6111's DIP switches adjust CPU speeds (from 200MHz to 333MHz). Three fan header connectors dot the siliconscape, while all your favorite I/O ports (including USB) sit where they belong—on the ATX I/O connector.

Component layout is well organized, with four hefty 168-pin DIMM sockets holding a maximum of 256MB of RAM. The heatsink on the 440LX AGPset chip is a blessing, given the chip's location directly under the CPU.

The MS6111 tallied close wins in almost every benchmark thrown at it, including our new AGP tests. While DMA access wasn't as zippy as Tekram's P6K40-A4 board, it certainly held its own over practically everything else, including ASUStek's P6L97 board (reviewed in *boot* 15).

We would've preferred another PCI slot in lieu of one of those accursed ISA slots; nevertheless, the Achme MS6111 is a surprisingly fast motherboard that deserves serious ogling.



It's fast, it's feisty, and it's mean—it's the Achme MS6111, and it packs performance galore.

THE STATS: BIOS: AMI v1.1 I RAM Support: 256MB of unbuffered 168-pin 3.3v EDO DRAM or SDRAM

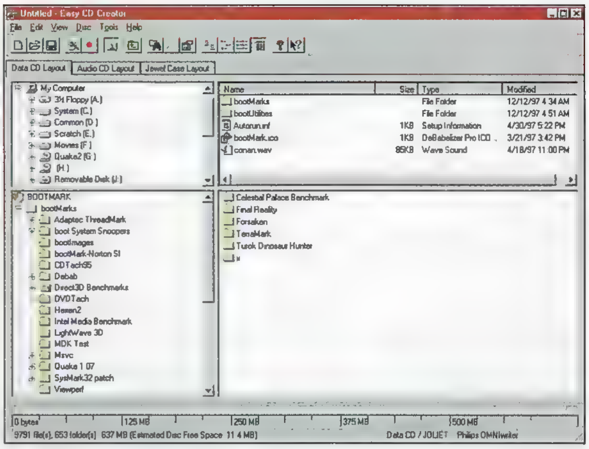
Price ***$190***
Company ***Micro Star***
Phone ***888.224.6348***
URL ***www.achme.com***

boot verdict 9

Spinning **Gold**

Mastering the fine art of CD recording

With the life span of a recorded CD-R disc estimated at 100 years, most of us won't be around to see the data we've written to disc die of old age. Unfortunately, this also means our failures will last just as long (barring the untimely destruction of the offending disc). Both Easy CD Creator Deluxe *and* CD Architect *go a long way toward making the CD-mastering process bulletproof.*



My Computer
3½ Floppy (A:)
System (C:)
Common (D:)
Scratch (E:)
Movies (F:)
Quake2 (G:)
(H:)
Removable Disk (J:)

Name	Size	Type	Modified
bootMarks		File Folder	12/12/97 4:34 AM
bootUtilities		File Folder	12/12/97 4:51 AM
Autorun.inf	1KB	Setup Information	4/30/97 5:22 PM
bootMark.ico	1KB	DeBabelizer Pro ICO ..	3/21/97 3:42 PM
conan.wav	85KB	Wave Sound	4/18/97 11:00 PM

BOOTMARK
bootMarks
Adaptec ThreadMark
boot System Snoopers
bootImages
bootMark-Norton SI
CDTach95
Debab
Direct3D Benchmarks
DVDTach
Hexen2
Intel Media Benchmark
LightWave 3D
MDK Test
Msvc
Quake 1 07
SysMark32 patch
Viewperf

Celestial Palace Benchmark
Final Reality
Forsaken
TenaMark
Turok Dinosaur Hunter
x

0 bytes | 125 MB | 250 MB | 375 MB | 500 MB

9791 file(s), 653 folder(s) 637 MB (Estimated Disc Free Space 11.4 MB) Data CD / JOLIET Philips OMNIwriter

Creator's new four-pane CD construction view makes it easy to know exactly what's going on your disc.

Easy **CD Creator** Deluxe 3.0

boot KICK ASS! PRODUCT

Say hello to the new *CD Creator* and say goodbye to buffer underruns. Adaptec's taken the old *CD Creator*, originally developed by Corel, and replaced the plumbing with the phenomenally stable XCD engine that formerly powered its *Easy CD Pro* software. The result is the easiest and most stable CD-R mastering software on the planet.

CD-R writing has always been a sensitive process, just ask anyone who's sat waiting for a burn to finish, fearing the wrath of the underrun gods. Adaptec has taken its XCD engine to new heights, shielding the burn process from everything but the most unstable app. We amazed ourselves by burning a disc while playing *Quake II* and running *Outlook 97* in the background. You may now permanently rid your mind of the notion of a dedicated duping station.

Like its predecessor, *Easy CD Creator* includes several programs for more specialized content, such as *PhotoCD* and *VideoCD*, as well as the easy-to-use *CD Copier*. The coolest new addition, however, is *CD Spin Doctor*, which takes analog audio through the line-input jack of your sound card and lays down clean digital tracks onto CD. Filtering options go a long way toward reducing the audible clicks, pops, and hisses found on the source, and normalizing the volume of different tracks. Simple audio tweaks can be accomplished via the included sound editor. Through *Spin Doctor*, you can also add tracks from other CDs for mixed CD nirvana.

With excellent features and support for just about every CD-R under the sun, *Easy CD Creator Deluxe 3.0* is a definite must-have for every CD-R owner.

—Sean Downey

TRY IT ON THE DISC

The update to CD Creator Deluxe *addresses software incompatibilities with Symantec's* Internet Fast Find *and Microsoft's* Internet Explorer 4.0, *as well as adding support for ISO 9660 image files.*

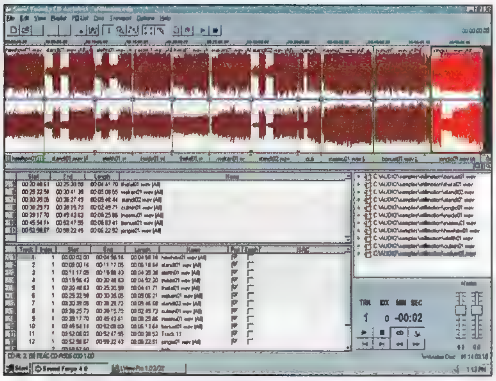
Price *$99*
Company *Adaptec*
Phone *800.442.7274*
URL *www.adaptec.com*

boot verdict 9

Sonic Foundry **CD Architect**

TRY IT ON THE DISC

Until now, good audio CD-mastering software was either difficult to use or simply not available for the PC, as it has been for the Macintosh. Even Adaptec's *Easy CD Creator* falls short of truly professional, glass-master-quality audio discs. Enter *CD Architect* by Sonic Foundry to set things right.



With* CD Architect, *everything you need is on one screen—no tabs or menus to shuffle through.

It can be configured as a stand-alone product or as a plug-in to one of the best audio editors on the market, *Sound Forge 4.0*. This powerful combination makes for easy slicing and dicing of your tracks before committing them to gold. Bouncing back and forth between the two programs is nearly seamless and puts a lot of power in your hands. Using *SF4.0*'s regions editor, *CD Architect* can limit a track to just that portion of a (much larger) .wav file, saving you the hassle of creating a separate file on your hard drive.

CD Architect's two drawbacks are its outrageous price and the fact that it is sometimes difficult and cumbersome to renumber or insert tracks, without mucking up your hard work.

Track-at-Once and Disk-at-Once are both supported, as well as full PQ list editing, including Copy Protect and pre-emphasis flags, UPC, MCN, and ISRC codes. Index marks and pause times are supported, and with 99 tracks per disc with 99 sub-indices per track, you won't come up short on those larger projects. When done, you can print a fully detailed cue sheet. Q data is extracted from CD audio tracks as well, to save you the task of re-creating them.

To help prevent you from making a $4 coaster, CD Emulation mode allows a preview of the disc before it is burned. Think of it as WYHIWYG for audio. The toolbar can be customized, as well as the two-second default between tracks. Volume curves can be created and resized on the fly, with new handles a mouse click away and a master volume adjustment supporting –96dB to +20dB attenuation or gain respectively. One of the phatest features is the auto-crossfade; drag one clip over another and the curve self adjusts itself, making you the DJ mix-master you always wanted to be.

—Daevid Vincent

Price *$395*
Company *Sonic Foundry*
Phone *800.577.6642*
URL *www.sfoundry.com*

boot verdict 8

Longbow 2

As real as it gets

boot KICK ASS! PRODUCT

CHECKLIST

Longbow 2
Version: 2.07F

Maximum Resolution/Color
640x480/16-bit

Win95 Native

Native 3D Hardware Support
3Dfx Glide

DirectX
DirectDraw DirectSound
DirectInput

Multiplayer
LAN Direct/serial
TCP/IP Modem

Multiple CDs

Specialty Controllers
Win95 compatible Throttle
Rudder

When it was released in 1996, *AH-64D Longbow* was a knockout. Now, with a few well-targeted improvements, *Longbow 2* makes its predecessor look like *River Raid* on the Atari 2600.

Longbow 2's graphics engine has been rewritten from the ground up to take advantage of 3D hardware, specifically 3Dfx Voodoo. New particle effects such as dust-tracked vehicles and multipart explosions, as well as smoke trails displaying perfect translucency, give a lot of detail to ooh and ahh over. And multiple-point light sourcing in rocket launches and explosions makes night missile strikes look like CNN footage of Desert Storm.

The maps, including the California desert and the scrubby hills of Azerbaijan, may not be as dramatically convoluted as those in, say, *EF2000 V2.0*, but they actually look more realistic. The game's new terrain generator considers up to 4,000 polygons before rendering the 2,000 polygons that make up the scenery. Helicopter exteriors are composed of about 800 polygons, detailed right down to the pilot's aviator shades.

Naturally, there's a price to be paid. The smallest install runs 170MB, the largest a crushing 420MB. With the 290MB medium install, new areas load from the CD-ROM, taking up to ten minutes to load and decompress textures from a 6x drive.

After that, however, load times become extremely fast, and overall performance is sharp. At 640x480, a 3Dfx-equipped system keeps things clipping along at 15fps to 18fps, even with all the visual options maxed out, and a Pentium II manages to push the frame rates up into the twenties.

The mission engine is totally revamped, based on a dynamic campaign generator similar to those in *EF2000 V2.0* and *iF-22*. You always have a choice of four mission types, and success depends on advancing the overall war effort, not just killing bogeys. New in *Longbow 2* is the ability to fly helicopters other than the Longbow itself: the OH-58D Kiowa Warrior and UH-60A/L Black Hawk. These seem primitive compared to the sci-fi avionics of the Longbow, but allow new mission challenges, such as troop insertion.

Also new in *Longbow 2* is a polygon-based virtual cockpit that lights up during missile barrages and explosions. Instruments remain live in virtual-cockpit view, and the HUD remains on-screen even in target padlock mode. Instrument systems are highly usable, provided you survive the barrage of acronyms. In early missions, for example, you'll want to switch targeting to TADS mode, missiles to LOAL. Keep your eyes glued to the IHADSS, and use the FLIR at night.

Flight characteristics are entirely believable, but options such as Hover Hold help tame the challenge. Using autopilot in waypoint mode, you can (mostly) sit back and lob Hellfire radar-guided missiles at anything that looks remotely hostile.

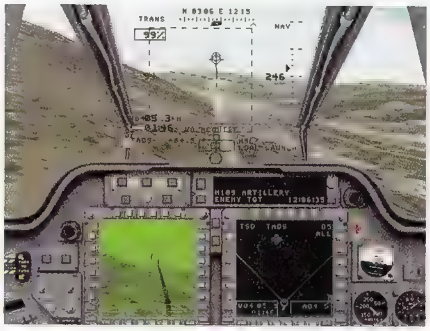
Another big enhancement in *Longbow 2* is multiplayer support, for TCP/IP, LAN, or modem/direct connections, allowing human pilots and copilot/gunners to fly cooperative campaigns or deathmatch missions. There will be a matchmaking service on the Jane's web site, but it wasn't up at the time of this review.

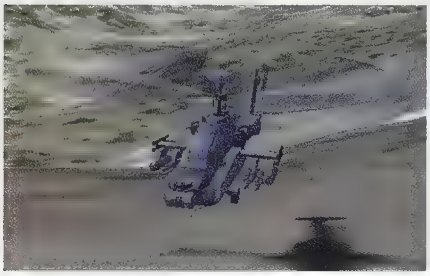
The only possible gripes are embarrassingly minor: the lack of an index in the half-inch-thick manual, and a DirectInput glitch that prevents re-assignment of joystick hat-switch functions. The Jane's team is working on a patch to correct the latter and is also considering ports to other 3D architectures.

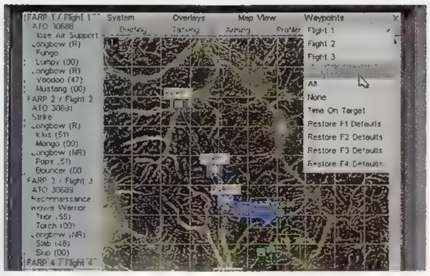
Otherwise, this is as close to a perfect product as you're likely to see. *Longbow 2* captures nap-of-the-Earth helicopter tactics in a simulation that's high-tech yet as much fun as seat-of-the-pants historical sims.

—Frank Lenk

Exterior views show frighteningly clear detail, including pilot and copilot-gunner.


TRANS
NAV
246
H109 ARTILLERY
ENEMY TGT
Longbow 2*'s sharply rendered virtual cockpit features readable instruments so you can track your Hellfire missile both outside and on infrared.*


Longbow 2*'s graphics present nap-of-the-Earth flying at its absolute best.*


FARP 1 / Flight 1
System
Overlays
Map View
Waypoints
Briefing
Taxiing
Arming
Profile
Flight 1
Flight 2
Flight 3
All
None
Time On Target
Restore F1 Defaults
Restore F2 Defaults
Restore F3 Defaults
Restore F4 Defaults
ATO 30688
Close Air Support
Longbow (R)
Fungo
Lumpy (00)
Longbow (R)
Voodoo (47)
Mustang (00)
FARP 2 / Flight 2
ATO 30681
Strike
Longbow (R)
Klus (51)
Mongo (00)
Longbow (NR)
Pops (51)
Bouncer (00
FARP 3 / Flight 3
ATO 30689
Reconnaissance
Kiowa Warrior
Thor (55)
Torch (00)
Longbow (NR)
Stab (48)
Slip (00)
FARP 4 / Flight 4
From the enhanced mission planner, you can chose from four flights.

Price $50
Developer Jane's Combat Simulations
Publisher Electronic Arts
Phone 800.245.4525
URL www.janes.ea.com

boot verdict 9

Gateway Solo 5100XL Notebook

Notebooka non grata

As evidenced by those whacked-on-smack supermodels, thin is in. But, beauty—as we all know—is only skin deep. Nowhere is this more apparent than with the Solo 5100XL. Oh sure, it looks mighty attractive, sporting a 14.1-inch screen and a cool low-profile design, but even with its embedded, genuine, mobile Pentium 266MHz processor and 80MB (yowza!) of SDRAM, the Solo 5100 proves that just because it's thinner doesn't necessarily mean it's a winner.

So what maladies are causing our malcontent? Let's start with the Solo 5100's performance. Even with that top-of-the-line processor, the Solo 5100 never comes close to living up to its pedigree. Hell, half the benchmarks landed deep in the red. Uh oh. 'Course, we've adjusted our bootMark scales to take into account new, emerging technologies, so some results can be attributed to that. But before you start shouting "no fair, no fair," bear in mind that Micron's Kick-Ass award-winning Transport XKE 233MHz (reviewed in *boot* 17) could easily consume the Solo 5100 for breakfast–using the old scale. Hmmm...

Another big problem? *Quake*. No matter how hard we tried—and we tried really hard—we just couldn't get the game to run under a DOS box. With page-fault errors abounding, we even tried contacting Gateway engineers, but they were stumped along with the entire *boot* team (we suspect the problem lies with immature video and audio drivers).

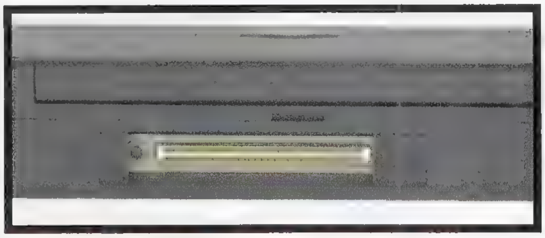
On paper, the individual components sound great; in reality, however, things aren't nearly as rosy. True, the CD-ROM consumed only 6% of the CPU cycles, but the transfer rate of only 5.7x was nowhere near the double digits promised in the product spec sheet. And you'll have to swap out the floppy for the CD-ROM, as the cool combo unit (featured on the Solo 9100, which scored much higher) doesn't fit into the newer, slimmed-down case. The 4GB hard drive fared better, posting a semi-respectable transfer rate of 3.26MB/sec, but with a 35% clock hit.

The video subsystem, consisting of a 2MB-equipped CT65555 chipset, was a workhorse and provided just enough oomph for surprisingly robust full-screen MPEG playback. And the 1024x768/24-bit maximum resolution and the ability to change the refresh rate when connected to other video sources are greatly appreciated. And lest we forget, the 14.1-inch display (somewhat of a rarity these days) is a thing of beauty, offering bright images with unparalleled off-axis viewing.

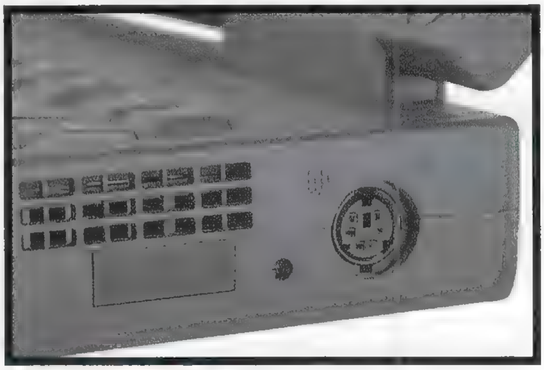
The Solo 5100 is adorned with all the aural accouterments you'd expect—wavetable sound, external volume control, built-in speakerphone, audio-in/out ports, and stereo speakers, although you may find the latter somewhat muffled when resting your hands in the normal 12 o'clock typing position. And in the "when will they ever learn" department, the Solo 5100 ships with Win95's MIDI playback defaulting to FM-synth—a *boot* "no-no."

One last thing. The Solo 5100 may have lost an inch or two around the outside, but don't be fooled into thinking this is a travel tote's dream. With a lap weight of almost seven pounds, the Solo 5100 is more a heavyweight pretender than a lightweight contender.

–*Bryan Del Rizzo*



HIDDEN BEHIND DOOR NUMBER ONE
At first glance, the rear panel seems adorned by only one port—for a docking station. But in case you can't figure it out (like a certain bootBoy we know), the door pops open to reveal an assortment of usual port connectors.



FULL OF HOT AIR
Next to the PS/2 port and just above the IrDA port, you'll find a tiny ventilation chamber.

under the hood

THE BRAINS

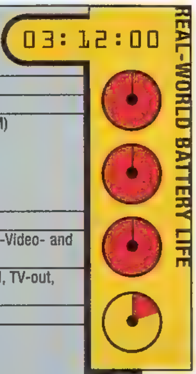
CPU	Pentium 266MHz with MMX
External Cache	512K pipeline burst
RAM	80MB SDRAM (144MB max)
Video	C&T 65555 (with 2MB EDO DRAM)

THE BRAWN

Hard Drive	Gateway EIDE 4GB
CD-ROM	Gateway EIDE 20x
Expansion Bus	Two Type II, one Type III, Zoomed-Video- and CardBus-compatible
I/O Ports	One PS/2, one serial, one parallel, TV-out, one monitor, two USB
Lap Weight	6 pounds, 12 ounces
Carrying Weight	7 pounds, 13 ounces

THE BEAUTY

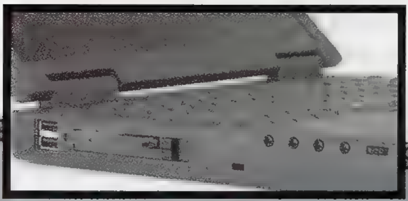
Display	14.1-inch active-matrix
Sound	ESS 1878 FM/wavetable
Video	1024x768, 24-bit color
Speakers	Stereo speakers
Communication	33.6Kbps PC card modem, software upgradable, x2 compatible; single IrDA port



THE BUNDLE Microsoft Office 97 Small Business Edition I Microsoft Bookshelf I Laplink for Windows 95 I McAfee Anti-Virus I Online Services

boot	down
:53	:07

ALREADY PACKED AND READY TO FLY
Now this is a nice change of pace—an extremely usable, flexible, and movable carrying case. Sure beats those carrying cases made of paper, huh?

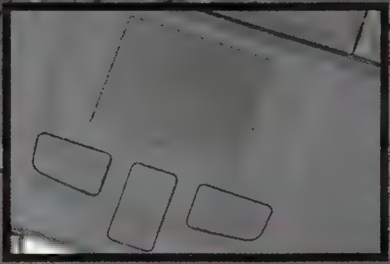


OUT IN LEFT FIELD

[illegible]

TURNING MY WORLD UPSIDE DOWN

The display properties include a utility that'll let you [illegible] the orientation of the screen. This is both functional (fold the screen completely flat to give a presentation of some sort) and very cool (rotate the screen 180 degrees and walk around the bootLab telling everyone you meet that the new Gateway notebook is "broken.") Good for hours of fun, but take our advice and don't try to use the touchpad at the same time.



[illegible]

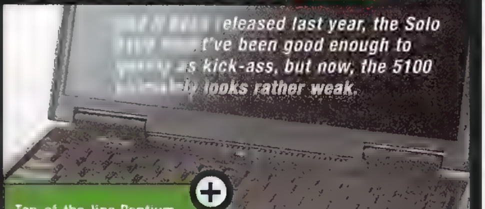
This is kinda cool—a rocker switch that performs traditional scroll and pan functions. Even better, it's completely customizable.

Gateway

Solo 5100XL

real-world benchmarking

Test	Benchmark	Unit	Score
CPU/MOTHERBOARD	*bootMark*		40.4
WIN95 APPS	*SYSmark32*		185
DIRECT3D	*ForsakenMark*	fps	0 (no D3D hardware)
HARD DRIVE	*Adaptec ThreadMark v1.0*	MB/sec	3.26
CD-ROM	*CD Tach/Pro v1.65*	K/sec	954
WIN95 VIDEO	*VidTach v1.52*	% played	100
DOS GAMING	*Quake v1.06*	fps	18.3
DIRECTX GAMING	*MDK PerfTest v1.4*		108
MMX PROCESSING	*DeBabelizer Pro*	secs	290
CPU/DISK	*Microsoft Visual C++ compile*	secs	146



[illegible] released last year, the Solo [illegible]'ve been good enough to [illegible] as kick-ass, but now, the 5100 [illegible] looks rather weak.

+

- Top-of-the-line Pentium (266MHz)
- Loads o' SDRAM
- Low-profile design
- Scroll mouse buttons
- Cool display properties
- 14.1-inch screen
- 1024x768 max resolution
- Long battery life
- External volume control

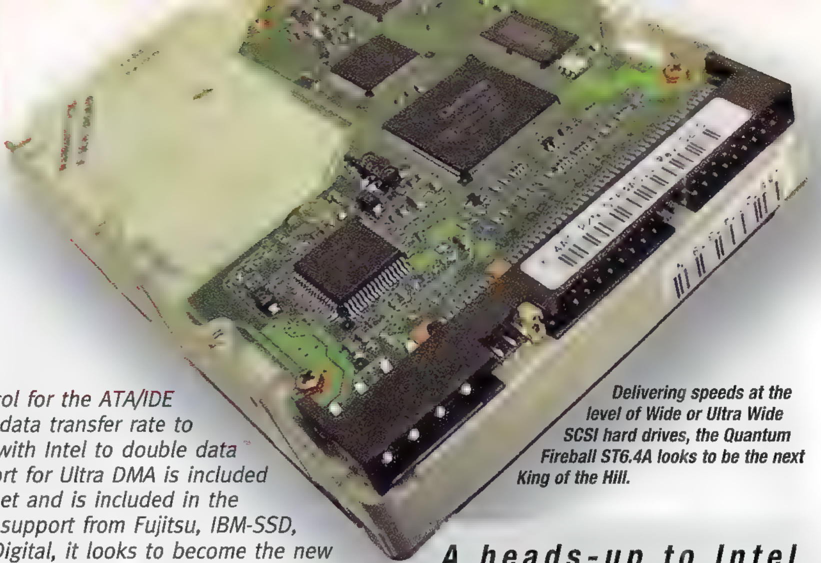
−

- Disappointing performance
- DOS-box problems
- No modular floppy/CD-ROM combo
- No gameport

Price $4,349,
Company Gateway 2000
Phone 800.315.2536
URL www.gateway.com

boot verdict 6

A complete breakdown of b[illegible] results is available on the *bootNet*. Point your [illegible] www.bootnet.com



Delivering speeds at the level of Wide or Ultra Wide SCSI hard drives, the Quantum Fireball ST6.4A looks to be the next King of the Hill.

Ultra **ATA**

Mr. DMA

Feel the need for speed? The Ultra ATA/DMA protocol for the ATA/IDE hard disk drive interface doubles the current burst data transfer rate to 33MB/sec. Quantum co-engineered the technology with Intel to double data throughput and prevent data corruption. Full support for Ultra DMA is included in PCI chipsets beginning with the Intel 430TX PCIset and is included in the 430LX, as well as third-party controller cards. With support from Fujitsu, IBM-SSD, Maxtor, Quantum, Seagate, Toshiba, and Western Digital, it looks to become the new IDE standard.

—Sean Cleveland

Quantum **Fireball** ST6.4A

boot KICK ASS! PRODUCT

Even though it's the first drive to incorporate Ultra ATA technology, the Fireball ST6.4A screams like a harrowed banshee. When hooked up to the 430TX chipset or the Promise Ultra33 controller, it boots in half the time as when it's not. Its formatted capacity of 6.4GB houses a 128K buffer wrapped in a 3.5-inch low-profile package with a rotational speed of 5,400RPM. The Fireball ST6.4A performs like a thoroughbred. This fact is backed up by its very impressive score of 4.22 from the Adaptec Threadmark bootMark. Seek times were clocked at just under 10ms on the average, and CPU utilization hovered around 36% when transferring heavy loads. This drive deserves a heads-up and demands respect from power users.

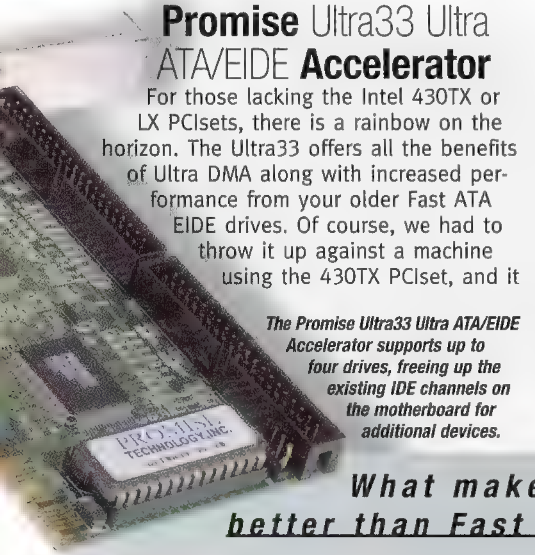
boot verdict 9

Price $400
Company Quantum
Phone 800.624.5545
URL www.quantum.com

A heads-up to Intel 430TX PCIset resellers

TRY IT ON THE DISC

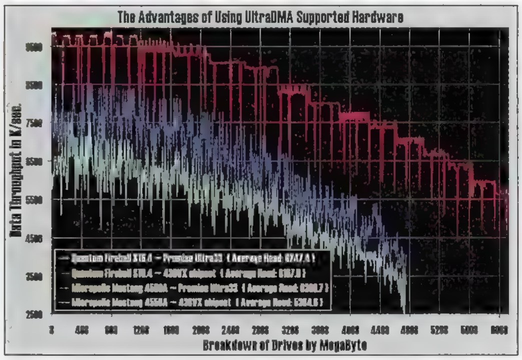
Several systems have come through the bootLab lately without proper drivers for the Intel 430TX PCIset. This can be detected by checking the System section of the Control Panel for devices missing drivers, specifically the PCI Bridge. The hard disk controller should be labeled "Intel 82371AB PCI IDE Controller". If it's not, you don't have the correct drivers installed. A utility from Intel is available that modifies Win95's .INF files and contains the necessary drivers. The utility can be downloaded from Intel's web site (developer.intel.com/design/pcisets/busmastr/bmfaq.htm) and is also on this month's bootDisc in the Workbench section.



The Promise Ultra33 Ultra ATA/EIDE Accelerator supports up to four drives, freeing up the existing IDE channels on the motherboard for additional devices.

Promise Ultra33 Ultra ATA/EIDE **Accelerator**

For those lacking the Intel 430TX or LX PCIsets, there is a rainbow on the horizon. The Ultra33 offers all the benefits of Ultra DMA along with increased performance from your older Fast ATA EIDE drives. Of course, we had to throw it up against a machine using the 430TX PCIset, and it performed on par, even with Fast ATA drives. This does raise a question regarding enhanced performance of older drives, though. They maintain a 30% performance gain on the average using older drives, and we only saw a 15% gain—but who's complaining? Using a PnP BIOS, it had no problems recognizing and configuring any of the drives we attached. Installation in both Windows 95 and NT 4.0 was painless, from fresh installs and into existing ones, although a floppyless install is not possible with the latter. It also supports the new CRC data-protection verification. This is definitely a good interim solution for speed mongers planning on upgrading their hard drive, because this card paired with the Quantum Fireball ST6.4A rocks!



Although backward compatible, the Quantum delivered dropouts when tested on machines not supporting Ultra DMA. Its performance was exemplary when paired with Ultra DMA supported PCIsets and the Promise Ultra33.

boot verdict 9

Price $79
Company Promise Technology Inc.
Phone 800.888.0245 x244
URL www.promise.com

What makes Ultra ATA/DMA better than Fast ATA

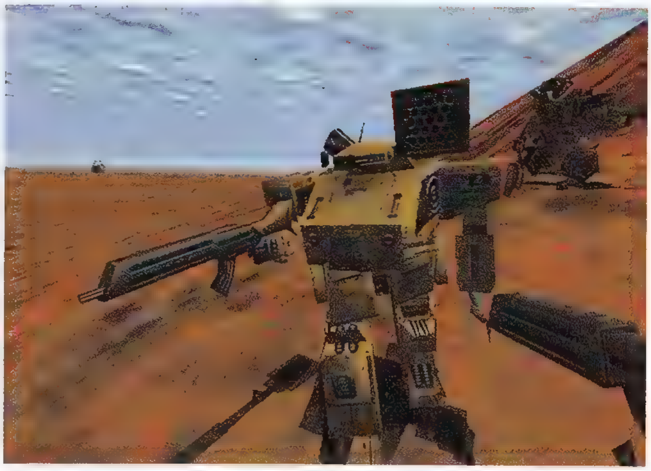
Fast ATA, the current IDE interface protocol, supports a burst data transfer of 16.7MB/sec. This includes PIO Mode specification 4, as well as DMA Mode 2. The new interface, Ultra DMA/33, transfers twice as much data per clock cycle through several innovations. By doubling the rate the buffer is emptied, it compensates for command turnaround overhead (the time it takes to keep the filling and emptying of the buffer in balance) and avoids "slipped revs" (where a sector needs to be rotated a second time past the drive head, allowing the host time to drain the buffer).

Timing margins have also been improved by the drive being the source of both the strobe (timing signal that starts and coordinates throughput) and the data during a read. Having both travel down the same direction on the cable instead of opposite directions essentially eliminates propagation delay. This reduces overall turnaround delay—the time it takes to read data and send it down the bus.

Icing the cake is Cyclical Redundancy Checking (CRC), which provides data-protection verification. CRC is calculated at the beginning of every burst by both the drive and the host and is stored in respective registers. At the end of each burst, the host sends its register to the drive, which then compares it to its own.

Heavy **Gear**

This ain't your momma's mech

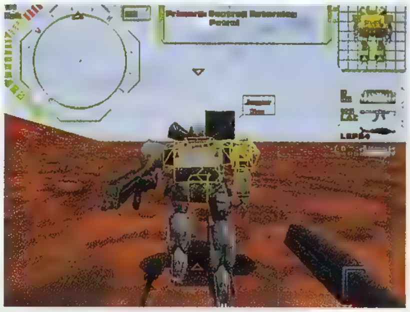


While the Gears and terrain are nicely textured, note the clouds overhead—results will vary depending on your hardware. This shot's from a 3Dfx Voodoo Rush board.

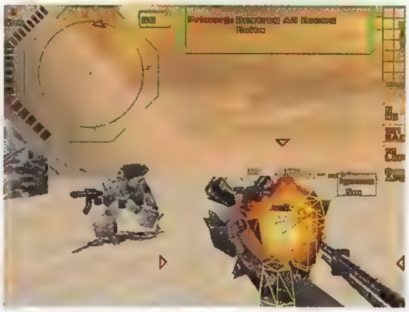
Lock and load that autocannon, baby, 'cause Activision's latest first-person robotic foray proves there's more than one way to skin a mech. Dream Pod 9's pen-and-paper RPG and tactical boardgame of mobile armored suits and 10mm mayhem has been successfully translated to the big CRT, and *Heavy Gear* delivers in-your-face robotic combat with authority.

Age-old rivals clash inside agile metal exoskeletons known as Gears. Whether you decide on the FMV-laden story mode or go for the random Campaign missions (where you can sign up for either side), one thing is certain: Once strapped inside your 4.3-meter tall widow-maker, it's clobberin' time.

A highly modified *Mechwarrior 2: Mercenaries* engine drives *Heavy Gear*'s lavishly texture-mapped polygon world. Upon rolling hills and urban cityscapes, 650-polygon Gears modeled and animated in *3DStudio* unleash all manner of destructive potential on each other. High-res texture maps give each Gear a tight, clean look. A P200MMX with 3D acceleration generates smooth 20fps+, although all versions bog down to mid-teens with multiple Gears and pyrotechnics about. Expect smoother rates with a P-II CPU. Unfortunately, the nonintrusive floating HUD slows down by a couple of fps. Texture-mapped transparent brushes take care of terrain features such as trees and billowing smoke clouds, while the particle system makes for explosive deaths and realistic missile effects. 3Dfx *Merc*'s dynamic colored lighting is included in all the hardware-accelerated modes, so laser traces and explosions light the landscape. The only differences among the accelerated versions are color saturations, minute details in bilinear filtering quality, and mip-mapping quality. Smooth, slow-moving textured clouds fill the skies, with no horizon gradation to be seen. But your results will vary depending on video card (the Vérité V2100 version produces smooth, filtered skies, while the Voodoo Rush/Glide version showed dithered, pixelated clouds).



Your Gear's on-board targeting system superimposes color-coded wireframes on enemy targets to show damage.



Multiple Gears team up to take you down. You'd better be faster on the trigger if you want to see the next mission.

Unlike FASA's lumbering behemoths, *Heavy Gear* units can gracefully duck, sidestep, and swap weapons on-field. The game's physics engine allows Gears to be knocked off their feet, sent tumbling down steep mountain slopes, and shaken by heavy-weapon recoil. And since Gears aren't as battlehardy as those massive *MW2* mechs, you'll find crouching behind rock outcroppings and hiding behind wreckage come in handy when a salvo of armor-piercing missiles screams your way.

3D audio support and Soundelux's excellent audio engineering perform orbital bombardments on your eardrums, while force feedback keeps compliant joysticks recoiling with every shot fired.

But *Heavy Gear* is far from perfect—texture seams are blatant, while Z-buffering problems cause triangles to disappear when they shouldn't, resulting in missing chunks from mountains and buildings. The terrain generator suffers from visible redraw, although some levels use fogging to hide these discrepancies. The game hiccups occasionally during play, although load time is kept to a minimum. You'll have teammates to order around, but you won't have the intricate squad-level command structure that made Looking Glass's *Terra Nova* such a pleasure to play. Multiplayer mayhem is handled over all your favorite hook-ups. Players battle it out in a deathmatch-styled one-on-one or fight in a user-set number of missions.

While the Gears are lifted blue-print-perfect from the rulebooks, the cheesy live-action FMV with B-grade acting superimposed on SGI O2/Wavefront-rendered scenery mocks the original Anime-inspired designs. Gear-on-Gear close combat is reduced to simple ramming attacks, unlike the pen-and-paper's punching, kicking, and melee weapon-based system (although you can step on infantry—cool!).

Despite these flickers of flaws, *Heavy Gear*'s combination of smooth graphics, tight gameplay, and intense, hard-hitting action will have you emptying your missile in no time flat.

—Andrew Sanchez

CHECKLIST

Heavy Gear
Version: 1.0

Maximum Resolution/Color
640x480/16-bit

Win95 Native

3D Acceleration
Direct3D

Native 3D Hardware Support
Rendition Redline
3Dfx GLIDE

DirectX
DirectDraw DirectInput
DirectPlay DirectSound

Multiplayer
LAN Modem Direct/serial
TCP/IP

Specialty Controllers
Force feedback Throttle
Rudder

Price $50
Developer Activision/Dream Pod 9
Publisher Activision
Phone 310.473.9200
URL www.activision.com

boot verdict
9

Fallout

TRY IT ON THE DISC

Life after the bomb

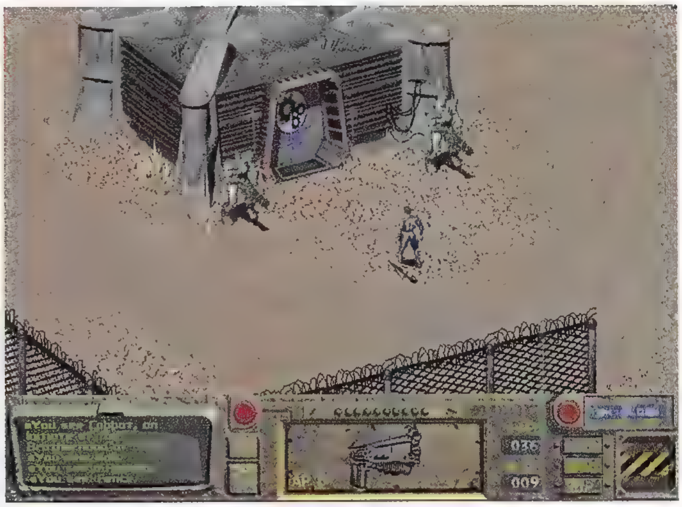
Fallout, the latest RPG from Interplay, is set in a grim and merciless world, where after a nuclear holocaust mutant beasts, unscrupulous gangs, and downtrodden survivors roam.

Once you get past the peculiar user interface, *Fallout* takes off into an open-ended frenzy of pure RPG adventure. You can participate in more than 50 mini-quests throughout a desert wasteland, shadowed by the ultimate quest to find a replacement module for the water processor in your underground vault.

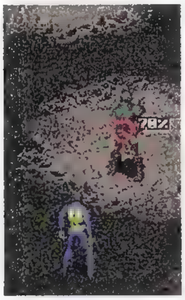
Character creation is comprehensive, with the ability to bring your character up from scratch, assigning points to abilities, skills, and a broad assortment of quirks, all of which affect game mechanics. Presented in an isometric view, the graphics in *Fallout* are sprite-based, with 15 frames of animation per character and per weapon type. Sometimes it's difficult to determine what's around when you're indoors, as only parts of rooms are visible. The alienating interface offers little help, with its strange assortment of right click modal toggles (move, use, and target) and keyboard commands.

CHECKLIST

Fallout
Version: 1.0
Maximum Resolution/Color
640x480/8-bit
MS-DOS Executable
Win95 Native
WinNT Compatible
DirectX
DirectDraw DirectSound
DirectInput



Fallout ***is a deep adventure with powerful allies and strong opponents.***



Combat is slow, but quite dramatic.

But true RPG fans will dig *Fallout*. There are plenty of characters to chat with and offend, and they'll remember previous encounters and treat you accordingly. Fans of fast action won't find it here, as the turn-based combat system is slow and chunky; you have to proceed through a multitude of mouse clicks to move and target an opponent. Death scenes, however, are deliciously gruesome—sure to offend some and impress others.

The world of *Fallout* is deftly crafted, albeit quirky, with its vacuum-tube, 50s style. It may be only single-player, but gamers are offered enough adventure to be enthralled for quite a while in this vast wasteland.

—Dan Simpson

Price ***$50***
Company ***Interplay***
Phone ***714.553.6655***
URL ***www.interplay.com***

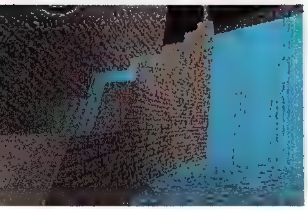
boot verdict 8

Defiance

TRY IT ON THE DISC

First attempt at a last stand

Defiance is a "little shooter that could have been," with interesting approaches and disappointing results. The craft handles well despite quirky controls (such as using the throttle to look up and down). Textures are eerie and level layout is interesting, but poor frame rates and hokey monsters seriously encumber this game.



Defiance***'s cool level designs would benefit from anti-aliasing.***

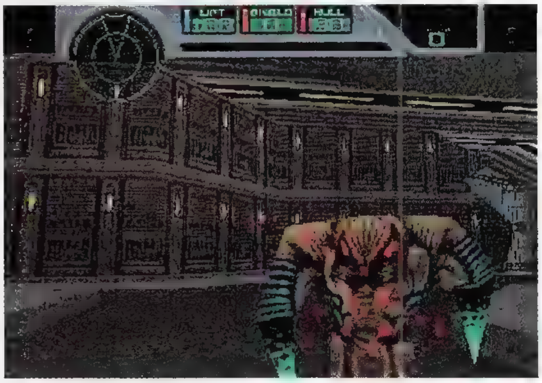
The sound effects and story line are all top-notch, which only amplifies the least-inspiring portions of *Defiance*.

Despite its D3D acceleration, the polygon-pushing power in *Defiance* is paltry. With frame rates ranging from an appalling 12fps to 20fps at 640x480, the graphics leave much to be desired. Better anti-aliasing would improve the nearly nonexistent light-sourcing. Let's hope Avalon Hill makes releasing a Rendition or 3Dfx patch a priority to kick those frame rates beyond 25fps. However, certain gaming elements are irreparable.

CHECKLIST

Defiance
Version: 1.0
Maximum Resolution/Color
1280x1024/16-bit
Win95 Native
3D Acceleration
Direct3D
DirectX
DirectDraw DirectSound
DirectPlay DirectInput
Multiplayer
LAN
Specialty Controllers
Win95 compatible

The grave mood set by the graphics and music is broken up by silly, Muppet-like monsters that are too corny to be threatening. Couple this with shoddy AI—the monsters horde in to attack and then back off without reason—and you're left with frustratingly banal opponents. Thankfully, *Defiance* is capable of an eight-player death match via TCP/IP or IPX.



Defiance ***will make your skin crawl, as will your frame rates.***

With a bit more tweaking, the game could've really rocked. Cool level design, an engrossing plot, and swanky sound effects reveal this game's potential.

—Dan Simpson

Price ***$40***
Developer ***Visceral Productions***
Publisher ***Avalon Hill***
Phone ***410.254.9200***
URL ***www.avalonhill.com***

boot verdict 5

Sid Meier's **Gettysburg**

Spend time above the Mason-Dixon line

Sid Meier's Gettysburg faithfully recreates both the tactics and the historical feel of its subject to the point where you'll forget about every other Gettysburg game you've seen. It's a real-time game, fought on the regimental/brigade level, with a mouse-click changing the scale of command. Thanks to a smooth, intuitive interface, even a wargaming newcomer can quickly understand the subtleties of deploying skirmishers, forming battle lines, and marching in maneuver columns, and the importance of flanking the enemy's line.

CHECKLIST

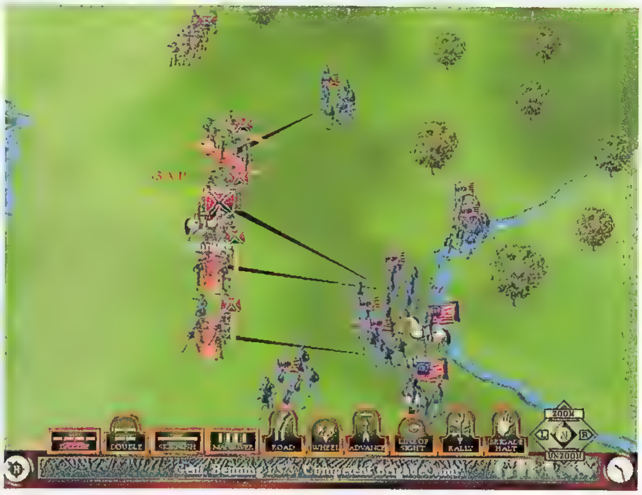
Sid Meier's Gettyburg
Version: 6.0

Maximum Resolution/Color
800x600/256-bit

Win95 Native

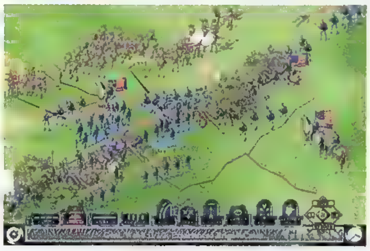
DirectX
DirectDraw DirectSound
DirectPlay

Multiplayer
LAN Modem Direct/serial
TCP/IP

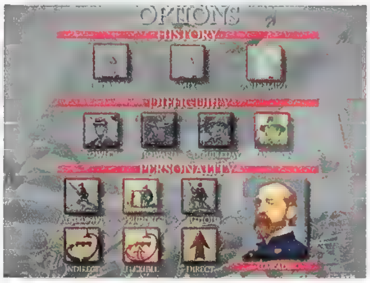


A Rebel brigade holds the high ground in **Sid Meier's Gettysburg.**

Animated formations move realistically, losing cohesion when crossing a creek or struggling through dense woods. The default pace of the game (adjustable) seems just right; it's rapid enough to create tension and surprise, but not so hectic that you don't have time to make informed command decisions. Typical of the felicitous detail: you can tell a unit's relative strength or morale by watching the regimental flags—if they stand out proudly in the wind, that unit is in fighting trim, but if they droop forlornly, it's sufferin' and should be rested before further combat.



In Pickett's Charge the Rebs can win, if you support the main attack strongly.

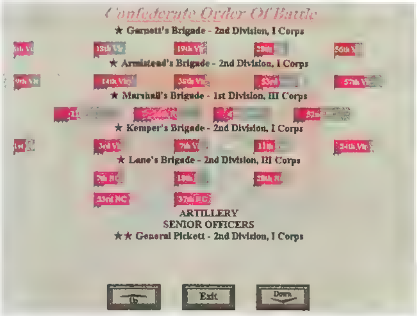


SMG lets you easily customize your AI enemy's style of generalship.

What prevents gameplay from lapsing into the been-there-done-that syndrome is Firaxis's decision to present the battle as a series of discrete but linked engagements, a compendium of all types of combat experienced during the Civil War: confused meeting engagements, tenacious defenses, and desperate assaults. You can fight these battles in historical order, or you can opt for completely ahistorical randomization. Most gamers will probably opt for a mixture of historical and random but logical scenarios.

SMG is an absolute gas to play. The fine-grained detail is just there, accurate enough to please the pickiest grognard, but the action is so dynamic, the sense of *being there* so intense, that everything about the game radiates a zesty sense of sheer fun. The mix-and-match scenarios, the customizable difficulty levels, and the full range of multi-player options (up to eight players via Internet/LAN) ensure near-infinite replay value. Solo play is enhanced by a crafty and unpredictable AI that faithfully reproduces whatever style of enemy generalship you choose, from cautious (Joe Hooker or Joseph E. Johnston) to head-on aggressive (Ulysses Grant or Stonewall Jackson).

The graphics may seem cartoony at first, but they fit the overall mood handsomely. The game has one major problem—when you scroll the map, the terrain blanks out, leaving only a bilious green background and some lettering. I can't think of another wargame in which this happens, and it's annoying as hell. Firaxis is considering a patch.



Confederate Order Of Battle

★ Garnett's Brigade - 2nd Division, I Corps

★ Armistead's Brigade - 2nd Division, I Corps

★ Marshall's Brigade - 1st Division, III Corps

★ Kemper's Brigade - 2nd Division, I Corps

★ Lane's Brigade - 2nd Division, III Corps

ARTILLERY
SENIOR OFFICERS
★★ General Pickett - 2nd Division, I Corps

The Order of Battle screen shows how all your units are faring from moment to moment.

SMG is a sleek, fiercely addictive, hugely entertaining game that's remarkably easy to slide into, yet full of challenge. It's such a fresh, creative take on the subject that it will cause veteran gamers to rediscover the drama of that epic struggle, even as it seduces newcomers who might never have tackled a historical simulation before.

—Bill Trotter

Using the Big Guns

Proper employment of artillery can mean the difference between victory and defeat. Always attempt to place your guns on commanding ground (use the "check line-of-sight" function to see what the gunners "see") and check their targeting. Click and drag from battery to target—if you see a green arrow, the target can be hit; a black arrow means it's either out of range or blocked, so you need to move the guns somewhere else. Rifled weapons have the longest range, but smooth-bore guns (because they can fire cannister) are more lethal at close range.

Price $50
Developer Firaxis Games
Publisher Electronic Arts
Phone 800.425.4525
URL www.gettysburg.ea.com

boot verdict 9

backpack bantam Parallel Port **CD-ROM** Drive

An unremarkable, but respectable receptacle

As far as portable CD-ROM drives go, the backpack bantam is easy to install, easy to set up, and (best of all) easy to use. But there's really nothing else here to wow you.

The backpack bantam plugs directly into the parallel port, so installation is quick and painless. Notebook aficionados don't have to worry about plugging in a PC card, and desktop users will appreciate the built-in pass-through adapter keeping the printer securely connected. Software drivers are included, as is a tiny DC adapter.

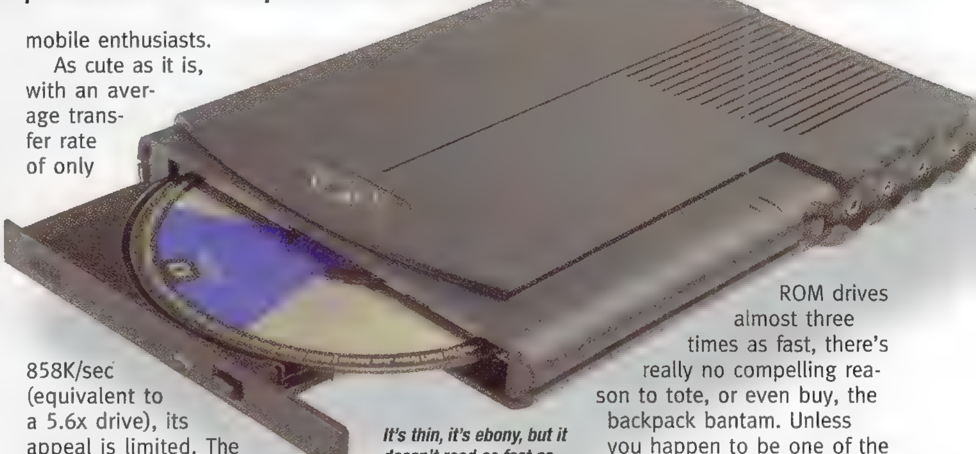
The drive also includes a built-in FM synthesizer, so you can use it for MIDI and digital playback and recording. One input and three output jacks (including ones for a microphone and headphone) and the volume control are nicely situated along the right side of the case.

Even better, the backpack bantam—with cables and power adapters—weighs less than two pounds, perfect for mobile enthusiasts.

As cute as it is, with an average transfer rate of only 858K/sec (equivalent to a 5.6x drive), its appeal is limited. The drive isn't suitable for AVI or MPEG playback—frame rates were very choppy—and it struggled to keep up data flow. Worse yet, during our extensive CD-ROM tests, the backpack bantam clocked in with a 91% CPU utilization rate. Yuck.

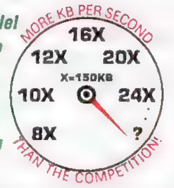
Considering most new notebooks include CD-ROM drives almost three times as fast, there's really no compelling reason to tote, or even buy, the backpack bantam. Unless you happen to be one of the jammy bastards still using a 4x drive and a non-Pentium class PC, the backpack bantam is not a serious competitor.

—Bryan Del Rizzo



It's thin, it's ebony, but it doesn't read as fast as Naomi Campbell.

bantam is the fastest parallel port cd-rom drive. On the parallel port, speed cannot be measured in X's. The bantam uses our patented technology to outperform the competition.



Don't be fooled by the packaging. The backpack bantam doesn't perform anywhere near a 24x CD-ROM.

boot verdict 5

Price $349
Company Micro Solutions
Phone 800.890.7227
URL www.microsolutions.com

Panasonic **EAB** MPC **250**

A sonic stubbed toe

The best sound card in the world sounds flat when pumped through substandard speakers. So goes the Panasonic EAB MPC 250, a speaker system that fails to excite or delight, and delivers the sonic equivalent of a stubbed toe.

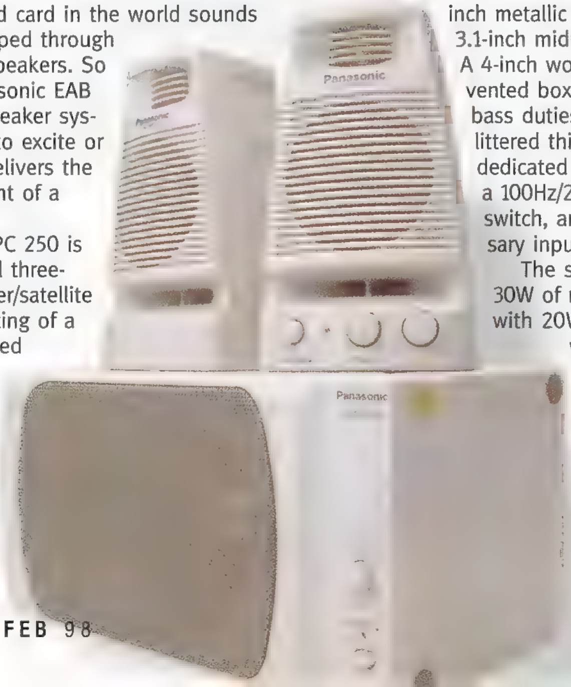
The EAB MPC 250 is your traditional three-piece subwoofer/satellite combo, consisting of a pyramidal vented satellite that houses a 0.8-inch metallic tweeter and a 3.1-inch midrange speaker. A 4-inch woofer inside a vented box takes care of bass duties. Panasonic littered this box with a dedicated volume control, a 100Hz/200Hz crossover switch, and all the necessary inputs and outputs.

The system claims 30W of maximum power, with 20W going to the woofer and 5W per satellite, but you wouldn't guess it from the anemic tones emanating from the woofer. With the 100Hz crossover setting, the sub feebly kicks beats down to about 55Hz before spiraling into an inaudible abyss. At 200Hz, everything's louder, but at the expense of speaker control and cleanliness. The lone 4-inch has serious trouble handling bass transients—Quake explosions dissolve into a rattling, distorted mess. The twin volume controls are also wacked—there's no master volume whatsoever! Nothing's worse than turning down the satellites, just to be bombarded by some scruffy bass.

The satellites do sound good, conveying a clean center channel and solid stereo separation, but don't expect super-crispy treble, despite the equalization knob.

Pair the satellites with a more worthy bass box, and this system may have a chance. But as is, there are much more interesting ear toys out there to indulge in.

— Andrew Sanchez

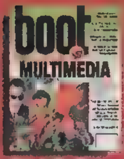


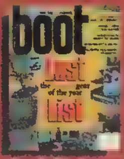
Both satellite and subwoofer enclosures are vented. But, the lackluster bass box has gotta go.

boot verdict 3

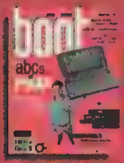
Price $99
Company Panasonic
Phone 800.662.3537
URL www.panasonic.com

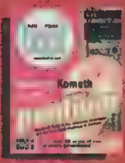
BACKISSUES

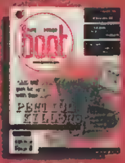




backissues







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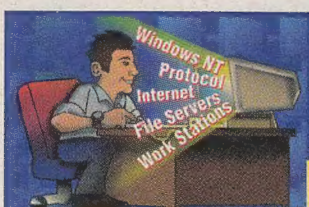

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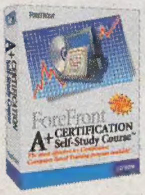

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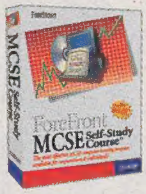

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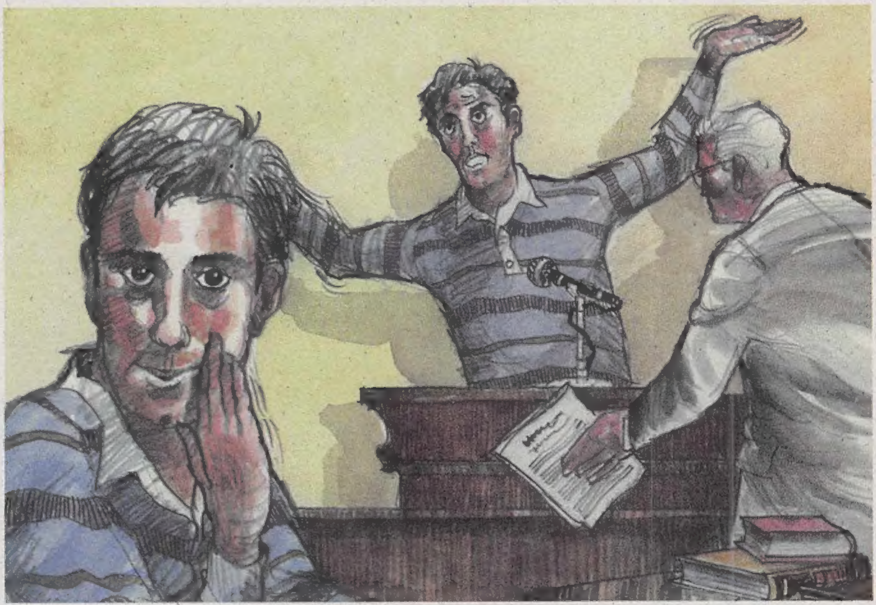


Camaro pleaded innocence on the witness stand as the plaintiff turned to the gallery and whispered, "Got 'im." Camaro was later threatened with a contempt-of-court rap for calling the bailiff "Officer Fife."

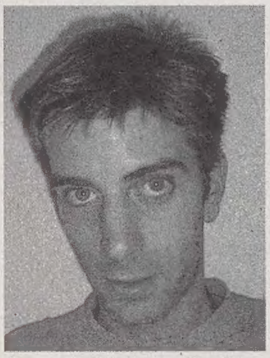
Game Developer Lashes Out In Court, Accuses Himself of Libel

WACKO, TEXAS — Cody Camaro, lead developer for Bad Chicken Software and the brain behind the long-overdue first-person shooter *Timmy Got Popped*, lost control in District Court today, accusing himself of libel for comments he made about himself in *boot* magazine.

Later, during a recess, Camaro started a scuffle with himself in the hallway and was restrained by members of his development team, as per his own request. While Camaro lunged at himself, he stood in defiance, screaming, "Bring it on, Bitch! Bring it on!"

Camaro testified that in an interview published in the December 1997 issue of *boot* magazine, he wrongly accused himself of fumbling the development of *Timmy Got Popped*, and challenged his own competence as an engineer and businessman. *boot* should have checked the accuracy of the accusations, Camaro argued, and is thus liable for damages to his reputation.

"I am a good-for-nothing liar," Camaro said. "If I had any idea how duplicitously I would have behaved while the tape was rolling, I never would have allowed myself to speak. So this is all *boot*'s fault. They know how reckless I am, my propensity for embellishment, my complete lack of tact. The magazine showed immense negligence in not protecting me from myself, for I—as the court, the jury and the game development community know—am a true idiot."



Camaro's rejected application photo for MTV's "Road Rules."

Just hours after the interview hit newsstands, fans of *Timmy Got Popped* flooded Bad Chicken's web site with letters of support, demanding the head of Cody Camaro as well as the heads of all other detractors who would sully the game's good name. Camaro responded on his own public .plan file, stating he was forming a "Binary Jihad" to "deal with" Camaro, and that "Texas-style justice" would prevail. Camaro also thanked his supporters for extending so much loyalty to a game they have never played before.

The trial, which began Tuesday, is expected to last three to four weeks and will also resolve whether *Timmy Got Popped* even has a projected release date, whether the game is actually a game at all, and whether the trial itself is actually happening.

While Camaro testified that he is not to blame for the game's repeated delays, he did admit that the first-person shooter is fraught with technical flaws, a problem he pins not on himself but on Camaro. Apparently, when a user shoots enemies in the game, the gun backfires and the user suffers full damage while targets escape unharmed.

Camaro defense lawyer Jimmy Watkins said the *Camaro v. Camaro* decision will come down to "who is the boss of whom," adding that whatever the verdict is, Camaro will likely emerge unscathed. Watkins said, "Camaro? The man's got nothing to worry about. Bad Chicken will pay for any trouble he might stir up. No, *boot* magazine is the one that should be worrying. I'll tell you what, they opened up a mean can of wigglers when they ran that interview. Jiminy Christmas, what were they thinking?"

In an unrelated trial, Camaro is accusing his teddy bear of treason.

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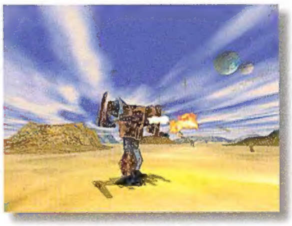

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